N.P.D.E.S. Construction Stormwater Pollution Prevention Plan ("SWPPP")

Arboretum Village Residential Subdivision Worcester, Massachusetts

Prepared under:

U.S. Environmental Protection Agency National Pollutant Discharge Elimination System 2012 General Permit for Storm Water Discharges From Construction Activities

Prepared for:

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Prepared by:

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N.P.D.E.S.

Construction Pollution Prevention Plan

Arboretum Village Residential Subdivision Worcester, Massachusetts

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Section 1.0 Site Description 1.0 Site Description

1.1 General Project Information:

This summary details pertinent aspects of development impacts and mitigation associated with the Arboretum residential subdivision, a proposed residential subdivision located on land off Sarah Drive and Tennyson Street in Worcester, Massachusetts. Houses will be constructed as market conditions dictate. The project is centrally located at approximate coordinates 42° 13' 40" N. and 71° 48' 21" W.

The project is being constructed in numerous stages as detailed below. It should be noted that stages were utilized for this document to further segment the project from the phases that were approved by the Worcester Planning Board. This was done to limit the extent of areas that will be open at any given time.

Erosion Control Stage A:

The first phase ("Sarah Drive Phase") of the current project consists of the continuation of Sarah Drive to Tennyson Street. As part of Sarah Dive Phase of this project, one proposed road totaling approximately 2,300 linear feet will be constructed. The proposed residential subdivision will be accessed off Sarah Drive and Tennyson Street via the proposed extension of Sarah Drive. The project is expected to be completed within a three year period following receipt of all applicable permits and approvals (all permits were in hand as of January, 2006).

Erosion Control Stage B:

The second stage ("Stage B" – Holly Terrace, Lilac Terrace & Pearlbush Path) consists of three cul-de-sacs constructed off Sophia Drive totaling approximately 1,900 linear feet of roadway and associated residential dwellings. The project is expected to be completed within a three year period following receipt of all applicable permits and approvals as market conditions dictate.

Erosion Control Stage C:

The third stage ("Stage C" – Honeysuckle Road) consists of a loop road connecting to Sarah Drive at both ends totaling approximately 2,000 linear feet of roadway and, including some residential dwellings. The project is expected to be completed within a three year period following receipt of all applicable permits and approvals as market conditions dictate.

Erosion Control Stage D:

The fourth stage ("Stage D" – Bittersweet Boulevard, Indigo Circle & Snowberry Circle) will consist of a road connecting Sophia Drive to Sarah Drive plus two cul-de-sacs totaling approximately 3,500 linear feet of roadway and associated residential dwellings. The project is expected to be completed within a three year period following receipt of all applicable permits and approvals as market conditions dictate.

Plans for future phases are being developed and this SWPPP should be amended to incorporate these phases/stages. Specialists in the fields of planning, wetland biology, wildlife biology, hydrology, and civil engineering have conducted an extensive review of existing conditions and

potential impacts of the proposed development on water supply, wastewater, wetlands, and drainage. The specialists have reviewed the proposed project, and their comments have been integrated into the project design.

The project phasing described in detail in section 1.7 below, consists of the construction of roadways, duplex units, and single family homes on the remaining house lots, as market conditions permit. Individual house lot construction plans, which include existing conditions, proposed structures and driveways, proposed grading, and erosion and sediment control measures, will be designed and prepared by H.S. & T Group and Gallo Builders to customer requirements as they are sold. The plans will be designed to avoid illicit discharges and wetland impacts through the construction period. These plans, in addition to supplemental erosion and sediment control measures described in section 2.1 below, will serve as the erosion and sediment control program for the project. It is anticipated that wetland impacts as a result of construction activities will be avoided if the erosion and sediment control measures outlined within the SWPPP are fully implemented.

1.2 Contact Information:

The current Owner and Operator of the property is:

Arboretum Village, LLC 31 Gallair Circle Holden, MA 01520 508-829-0676

Additional Site Operators:

There are no additional Site Operators in charge of daily operations at the site.

Stormwater Team

The Construction Site Manager, Inspector and 24-Hour Emergency Contact for the project is:

Ron Ringgard Arboretum Village LLC 31 Gallair Circle Holden, MA 01520 508-829-0676 Cell (774) 696-2204

The NPDES Stormwater Compliance Officer for the project is:

Ron Ringgard Arboretum Village LLC 31 Gallair Circle Holden, MA 01520

508-829-0676 Cell (774) 696-2204

1.3 Requirement to Post a Notice of Permit Coverage

A copy of the SWPPP shall be retained on-site during active construction periods. A sign shall be posted at a safe, publicly accessible location in close proximity to the project site. At a minimum, the notice must include the NPDES Permit tracking number and a contact name and phone number for obtaining additional project information. The notice must be located so that it is visible from the public road that is nearest to the active part of the construction site, and it must use a font large enough to be readily viewed from a public right-of-way. The SWPPP location shall include a copy of the EPA NOI, EPA authorization number, and construction site contact name and telephone number.

1.4 Description of Receiving Waters:

Surface runoff for the site drains to wetlands associated with an intermittently mapped unnamed stream. This stream flows in a generally southerly direction before emptying into the Blackstone River via the Dark Brook bypass canal. A copy of the most recent USGS topographic map (Worcester South Quadrangle, dated 1983) is appended.

A review of the EPA Approval Documentation for the New England States' TMDLs indicates that no TMDLs have been established for the site drainage area. A copy of the Massachusetts List of Approved TMDLs is attached. Stormwater from the site does not discharge directly to any Tier 2, 2.5 or 3 Waters.

1.5 Safe Drinking Water Act Underground Injection Control Requirements

No Class V UIC wells, including stormwater controls such as infiltration trenches, proprietary subsurface infiltration systems, drywells, seepage pits, or improved sinkholes, are proposed as described at Section 7.2.14.3 of the 2012 CGP.

1.6 Historic Preservation

The project site will utilize earth disturbing stromwater controls as described in Appendix E of the 2012 CGP. Based upon a review of the State Register of Historic Places 2010, published by the Massachusetts Historical Commission, there are no registered historic places located on or in the immediate vicinity of the proposed project. Therefore, the installation of subsurface stormwater controls shall have no effect on historic properties.

1.7 Endangered Species Certification

Based upon a review of the U.S. Fish and Wildlife Service's iPAC website, there are no listed species found within the vicinity of the project. Therefore, the project would qualify under Criterion 'A' under the Endangered Species Act Eligibility Criteria of the 2012 CGP which states that: "No federally-listed threatened or endangered species or their designated critical habitats are likely to occur in your sites action area." A copy of the U.S. Fish and Wildlife Service Natural Resources of Concern report for the site is appended.

1.8 General Construction Phasing

The infrastructure phase has been completed at the Arboretum Village Residential Subdivision, including paved roadways, utilities installation and stormwater management structures. Construction Phasing for the project consists of the construction of single family and duplex homes on the remaining house lots as market conditions allow. Prior to the commencement of these activities, all proposed perimeter sediment control barriers shall be installed and temporary erosion control measures shall be implemented. The sites will be cleared and grubbed and general site preparation and grading shall commence. All downstream catch basin inlets shall be protected with maintained silt sacks, filter wattle tubes or sediguards until final stabilization. Temporary diversion swales or berms leading to temporary sediment basins may be constructed, as needed, to capture and infiltrate sediment laden run off. Temporary stockpiling shall be located outside of the 100-foot Buffer Zone or properly contained and covered. Site flow patterns will be monitored daily and flow diversion dikes or berms and temporary sediment ponds may be installed on an as needed basis. Upon completion of final grading of topsoil in a given work area, any areas not stabilized by pavement or other means will be seeded with a grass seed mixture to provide for permanent cover. For slopes of 3H:1V or steeper, the prepared areas will be stabilized with a bonded fiber matrix (BFM) hydroseed, rip-rap, bark mulch, or seed and erosion control blankets. The driveway/parking areas shall be immediately stabilized with a binder coat of asphalt and a top coat upon final stabilization of the lot.

A detailed construction erosion and sedimentation control plan narrative, which includes periodic inspection and maintenance, sediment control barriers, stone check dams, diversion swales, stabilized construction exits, pavement sweeping, catch basin inlet protection, stock pile stabilization, temporary mulching and seeding, dewatering operations, permanent cover, and post construction activities, is described below in section 2.1. This plan will be implemented by the proponent during construction phases of the project.

1.9 General Construction Sequence:

The following is a general construction sequence that will be implemented as part of the construction of single family homes on remaining lots at the site.

- 1. Install Perimeter Sediment Controls and Natural Buffer Area Demarcation: Prior to the start of earth-moving activities, a sediment barrier will be installed along the proposed limit of work (i.e., boundary of Natural Buffer Area) as shown on the site plans. The sediment barriers shall consist of properly installed siltation fencing (i.e., the bottom few inches of the siltation fence installed in a narrow, trench and the trench filled with soil around the siltation fence), and where proposed, staked wattle, stump grinding berms, or double staked hay bales. Unless directed otherwise, the lower sediment control barrier shall be located at the limit of work disturbance and shall serve as the Natural Buffer Area demarcation. No earth work shall occur beyond (i.e., wetland side of) the sediment barrier. Accumulated sediment must be removed before it has accumulated to one-half of the above-ground height of any perimeter control.
- Inlet Protection: All catch basin inlets located downstream of construction activities
 will be protected with maintained silt sacks, Sediguard device or sediment filter
 log/wattle. The inlet protection devices must be inspected weekly. The devices must

be cleaned or replaced as sediment accumulates, the filter becomes clogged, and/or performance is compromised. Sediments accumulated adjacent to inlets must be removed immediately (i.e., by end of work day).

- 3. <u>Install Stabilized Construction Access</u>: Vehicle access shall be restricted to designated points. Sediment track out must be minimized onto off-site streets or other off-site paved areas. Construction access points/driveways that exit onto off-site areas shall be stabilized with a "tire scrubber" anti-tracking pad/berm. The pad for single family house lots shall be a minimum of 15 feet long, 12 feet wide and 6 inches deep with 2"-6" coarse aggregate. Any other bare construction routes or equipment staging areas shall be stabilized with gravel, wood chips, or temporary vegetation (e.g., annual rye grass). Any sediments inadvertently tracked onto paved surfaces shall be swept daily. Sediments shall not be hosed or swept into catch basin inlets.
- 4. <u>Land clearing and Grading</u>: Trees slated for removal shall be cleared and site grading shall commence. All exposed slopes shall be brought to finish grade and final stabilization immediately. Slopes in excess of 3H:1V shall be stabilized with rip rap hard-armoring, bonded fiber matrix (BFM) hydroseed or seed and erosion control blanketing. Install additional run-off control measures as grading progresses, to include temporary basins, dikes and swales. Areas where earth disturbing activities have/will cease for more than 7 days shall be immediately stabilized with seed (flat areas only), seed and blanket, blanket, wood chips, stone, poly, hydroseed, or hay mulch.
- 5. Stockpiling: Soil stockpiling shall take place in designated areas, outside of the 100 foot Wetland Buffer Zone if feasible. Piles shall be located outside of any demarcated Natural Buffer Areas and physically separated from other stormwater controls (e.g., sediment barriers between piles and sediment traps). Any stockpiles within the Buffer Zone must be covered to the extent feasible and contained with sediment control barriers. Any stockpiling that will remain idle for more than 14 days shall be contained with a staked bale or silt fence sediment control barrier, installed 5-10 feet off the toe of the pile; and where practicable, seeded, hydroseeded or covered with poly or tarpaulins.
- Topsoil Preservation: To the extent feasible, native topsoils shall be preserved at the site for use in final grading. Topsoils that shall not be utilized on site should be transferred to other locations for use.
- 7. Sediment Basins and Traps: Temporary sediment basins may be constructed, as necessary, to store and infiltrate run-off. The basins shall include a temporary stone and filter fabric, or hay bale bulkhead dam at the outlet structure to provide additional settling. The basin slopes and bottoms shall be stabilized with erosion control matting or stone, and a stabilized inlet and outlet using filter fabric and stone and stone or wattle velocity dissipation devices. Surface outlet requirements state that when discharging from basins and impoundments, permittees are required to utilize

outlet structures that withdraw water from the surface, unless infeasible. Temporary riser pipes, or skimmers, may be utilized to allow retention and treatment with controlled release of stormwater runoff during construction. The basins shall be excavated to provide storage for either the calculated runoff volume from a 2-year/24-hour storm, or 3,600 cf per acre drained. Basins will be inspected weekly, before and after significant rainfall events. Accumulated sediments will be removed once they reach no more than 50% of the sediment capacity.

- 8. Run-off Control and Conveyance Systems: As needed, diversion swales and/or dikes shall be constructed and stabilized utilizing stapled erosion control blanketing or filter fabric and crushed stone. Where feasible, runoff shall be diverted away from unstabilized areas and slopes. Stone or wattle check dams shall be installed along the length of swales at intervals which will provide non-erosive flow velocities, and stone splash pads shall be installed as needed at the outlets of swales to dissipate velocity energy.
- Minimize Soil Compaction: In areas of the site where final vegetative stabilization will occur (e.g., turf lawn) or where infiltration practices will be installed, the Construction Manager must either:
 - a) <u>Restrict vehicle / Equipment use</u>. Restrict vehicle and equipment use in these locations to avoid soil compaction; or
 - b) <u>Use soil conditioning techniques</u>. Prior to seeding or planting areas of exposed soil that have been compacted, use techniques (e.g., raking, tilling, furrowing) to support vegetative growth, if necessary and feasible.
- 10. <u>Surface Stabilization and Steep Slope Disturbance</u>: Immediately apply temporary or permanent stabilization measures; including sod, seed, hydromulch, bark mulch, poly, wood chips, hay/straw or crushed stone, on all disturbed areas where the slope is less than 3H:1V and where work is completed or will cease for more than <u>14 days</u>. These stabilization activities must be completed within 14 days of the temporary or permanent cessation of earth disturbing activities.

Steep slope disturbance shall be avoided until absolutely necessary in the construction sequencing. Slopes in excess of 3H:1V shall be stabilized immediately with stapled erosion control blanketing; Bonded Fiber Matrix (BFM) hydroseed; bark mulch, poly, or rip rap.

11. <u>Driveway</u>, <u>Parking Areas & Utilities Construction</u>: The rough graded parking areas and driveways may be pitched slightly, as needed, to divert run-off into stabilized diversion swales and/or dikes. As necessary, temporary swales with check dams or dikes and settling basins may be utilized on house lots to contain and treat stormwater. After the utilities have been installed on a given lot, the driveways and parking areas will be immediately finish graded and stabilized with a binder coat of pavement.

12. <u>Landscaping and Final Stabilization</u>: After construction is complete in a given area, any exposed soils will be stabilized with sod, loam and seed, hydroseeding and/or landscaping as shown in Table 1 below. Areas with slope steepness up to 4H:1V may be contained with sediment control barriers. Areas with slope steepness between 4H:1V and 3H:1V must be sodded, hydroseeded, bark mulched, rip rapped or seeded and stapled erosion control blanketing. Areas steeper than 3H:1V shall be stabilized with sod, BFM hydroseed, seed and blanket, rip rap, or bark mulched.

1.10 Single-Family & Duplex Building Construction and Final Stabilization Sequence:

The following is a general construction sequence that will be implemented for house construction and final stabilization at the site. The erosion and sedimentation control measures will be discussed in further detail in Section 2.1.

- Excavate for foundation/slab. Immediately temporarily stabilize exposed soils where earth disturbing activities have/will cease for more than 14 days;
- 2. Form and pour foundation/slab;
- Backfill foundation/slab and complete rough grading. Temporarily stabilize exposed soils as necessary with hydromulch (min. 2,200 lbs/acre), wood mulch, hay mulch (2 bales/1,000 sf), or similar;
- 4. Construct house, including framing, roofing, siding and interior;
- 5. Connect underground utilities;
- 6. Complete grading, pave driveway;
- 7. Conduct final cleanup of wood scraps, building materials, etc.;
- 8. Loam and seed lawn area. Use sod, seed and erosion control blanket, or bonded fiber matrix hydroseed applied at manufacturer's recommended rate for slopes in excess of 3H:1V. See Table 1 below for slope application materials. Re-seed as necessary to achieve solid vegetative cover.

1.11 Estimated Dates of Construction Activities

The following is a summary of the construction milestones anticipated for the proposed project. These dates are general due to the uncertainties associated with market conditions and weather.

- Project Commenced: 2006
- May 16, 2012

 Installation of erosion and sediment controls on Bittersweet Boulevard and house lots as they are sold. Commencement of clearing, grading, infrastructure, foundation and construction.
- June 1, 2012, complete temporary stabilization of any slopes and house lots under construction.

- September 1, 2012 Anticipated final grading paving of the roadway, stabilization of slopes, and any house lots under construction. Stabilize for winter.
- March 1, 2013

 Installation of erosion and sediment controls on Indigo Circle and house lots as they are sold. Commencement of clearing, grading, infrastructure, foundation and construction.
- June 1, 2013, complete temporary stabilization of any slopes and house lots under construction.
- September 1, 2013 Anticipated final grading paving of the roadway, stabilization of slopes, and any house lots under construction. Stabilize for winter.
- March 1, 2014

 Installation of erosion and sediment controls on Snowberry Circle
 and house lots as they are sold. Commencement of clearing, grading,
 infrastructure, foundation and construction.
- June 1, 2014, complete temporary stabilization of any slopes and house lots under construction.
- September 1, 2014 Anticipated final grading paving of the roadway, stabilization of slopes, and any house lots under construction. Stabilize for winter. September, 2014 - Anticipated Completion of current proposed phases of the Arboretum Village Subdivision.

Section 2.0 Erosion and Sediment Controls

2.1 General Construction Erosion and Sediment Control Plan

The objective of the Erosion and Sediment Control Plan is to minimize the area of exposed soil, prevent erosion and control sediment movement, control runoff rate and direction, and provide for rapid stabilization of exposed, erosive areas. Permittees are required to design, install and maintain effective erosion and sediment controls to minimize the discharge of pollutants. At a minimum, such controls must be designed, installed and maintained to:

- Control stormwater volume and velocity within the site to minimize soil erosion;
- Control stormwater discharges, including both peak flow rates and total stormwater volume, to minimize erosion at outlets and to minimize downstream channel and streambank erosion;
- Minimize the amount of soil exposed during construction activity;
- Minimize the disturbance of steep slopes;
- Minimize sediment discharges form the site. The design, installation and maintenance of
 erosion and sediment controls must address factors such as the amount, frequency,
 intensity and duration of precipitation, the nature of resulting stormwater runoff, and soil
 characteristics, including the range of soil particle sizes expected to be present on the site;
- Provide and maintain natural buffers around surface waters, direct stormwater to vegetated areas to increase sediment removal and maximize stormwater infiltration, unless infeasible:
- Minimize soil compaction and, unless infeasible, preserve topsoil;

Regular inspection and maintenance of these measures will occur throughout the construction phase of the project. The erosion and sedimentation control measures to be installed and the schedule for regular inspections and maintenance to be followed are detailed below.

2.2 Natural Buffers or Equivalent Sediment Controls

Lots will provide a minimum 50 foot Buffer Zone to surface waters, except as noted below. The subject remaining lots A-3, A-8 and A-9 have been approved or are currently in permitting by pertinent issuing authorities and Lots A-3 and A-8 were previously cleared prior to the promulgation of the 2012 CGP and therefore contain some natural buffer. A significant amount of the lots occur within the 50 foot Natural Buffer. Therefore maintenance of a 50 foot Buffer is infeasible. As depicted on the development plans prepared by H.S. & T Group, the following Natural Buffer Areas are provided to surface waters for the project:

- A minimum 20 foot Natural Buffer is provided to surface waters on Lot 3A;
- · A minimum 5 foot Natural Buffer is provided to surface waters on Lot A8; and
- A minimum 5 foot Natural Buffer is provided to surface waters on Lot A9.

These house lots A3, A8 and A9 qualify as "small residential lots" under the 2012 CGP and shall comply with the Small Residential Lot Compliance Alternative 1, to include double perimeter controls and a 7-day site stabilization schedule upon cessation of earth disturbing activities. The Natural Buffer Areas on said lots will be demarcated by the proposed sediment control barriers and no work will occur beyond these barriers. As necessary, velocity dissipation devices; including staked wattles, stone check dams, or haybale check dams, must be used to prevent erosion within the Natural Buffer.

2.3 Erosion and Sediment Controls / Stormwater BMPs

Perimeter Sediment Controls and Natural Buffer Area Demarcation: Prior to the start of earth-moving activities, a sediment barrier will be installed along the proposed limit of work (i.e., boundary of Natural Buffer Area) as shown on the site plans. The sediment barriers shall consist of properly installed siltation fencing (i.e., the bottom few inches of the siltation fence installed in a narrow, trench and the trench filled with soil around the siltation fence), and where proposed, staked wattle, stump grinding berms, or double staked hay bales. Unless directed otherwise, the lower sediment control barrier shall be located at the limit of work disturbance and shall serve as the Natural Buffer Area demarcation. No earth work shall occur beyond (i.e., wetland side of) the sediment barrier. Accumulated sediment must be removed before it has accumulated to one-half of the above-ground height of any perimeter control.

Stabilized Construction Access: Vehicle access shall be restricted to designated points. Where they enter onto off-site roadways, construction access points/driveways shall be stabilized with a "tire scrubber" anti-tracking pad/berm. The pad for single family house lots shall be a minimum of 15 feet long, 12 feet wide and 6 inches deep with 2"-6" coarse aggregate. Any other bare construction routes or equipment staging areas shall be stabilized with gravel, wood chips, or temporary vegetation (e.g., annual rye grass). Any sediments inadvertently tracked onto paved surfaces shall be swept daily. Sediments shall not be hosed or swept into catch basin inlets.

Land clearing and Grading: Trees slated for removal shall be cleared and site grading shall commence. All exposed slopes shall be brought to finish grade and final stabilization immediately. Slopes in excess of 3H:1V shall be stabilized with rip rap hard-armoring, bonded fiber matrix (BFM) hydroseed or seed and erosion control blanketing. Install additional run-off control measures as grading progresses, to include temporary basins, dikes and swales. Areas where earth disturbing activities have/will cease for more than 14 days shall be immediately stabilized with seed (flat areas only), seed and blanket, blanket, wood chips, stone, poly, hydroseed, or hay mulch.

Stockpiling: Soil stockpiling shall take place in designated areas, outside of the 100 foot Wetland Buffer Zone if feasible. Piles shall be located outside of any demarcated Natural Buffer Areas and physically separated from other stormwater controls (e.g., sediment barriers between piles and sediment traps). Any stockpiles within the Buffer Zone must be covered to the extent feasible and contained with sediment control barriers. Any stockpiling that will remain idle for more than 14 days shall be contained with a staked bale or silt fence sediment control barrier, installed 5-10 feet off the toe of the pile; and where practicable, seeded, hydroseeded or covered with poly or tarpaulins.

<u>Topsoil Preservation:</u> To the extent feasible, native topsoils shall be preserved at the site for use in final grading. Topsoils that shall not be utilized on site should be transferred to other locations for use.

Sediment Basins and Traps: Temporary sediment basins may be constructed, as necessary, to store and infiltrate run-off. The basins shall include a temporary stone and filter fabric, or hay bale bulkhead dam at the outlet structure to provide additional settling. The basin slopes and bottoms shall be stabilized with erosion control matting or stone, and a stabilized inlet and outlet using filter fabric and stone and stone or wattle velocity dissipation devices. Surface outlet requirements state that when discharging from basins and impoundments, permittees are required to utilize outlet structures that withdraw water from the surface, unless infeasible. Temporary riser pipes, or skimmers, may be utilized to allow retention and treatment with controlled release of stormwater runoff during construction. The basins shall be excavated to provide storage for either the calculated runoff volume from a 2-year/24-hour storm, or 3,600 cf per acre drained. Basins will be inspected weekly, before and after significant rainfall events. Accumulated sediments will be removed once they reach no more than 50% of the sediment capacity.

Run-off Control and Conveyance Systems: As needed, diversion swales and/or dikes shall be constructed and stabilized utilizing stapled erosion control blanketing or filter fabric and crushed stone. Where feasible, runoff shall be diverted away from unstabilized areas and slopes. Stone or wattle check dams shall be installed along the length of swales at intervals which will provide non-erosive flow velocities, and stone splash pads shall be installed as needed at the outlets of swales to dissipate velocity energy.

Minimize Soil Compaction: In areas of the site where final vegetative stabilization will occur (e.g., turf lawn) or where infiltration practices will be installed, the Construction Manager must either:

Restrict vehicle / Equipment use. Restrict vehicle and equipment use in these locations to avoid soil compaction; or

<u>Use soil conditioning techniques</u>. Prior to seeding or planting areas of exposed soil that have been compacted, use techniques (e.g., raking, tilling, furrowing) to support vegetative growth, if necessary and feasible.

Erosion Control, Surface Stabilization and Steep Slope Disturbance: The area of exposed soils shall be minimized through the use of temporary and permanent cover techniques. Vertical cut slopes (steeper than 1V:2H) should not be used unless cut is in rock or well cemented soil. Slopes steeper than 1V:2H should be stabilized with hard armoring utilizing rock rip rap. Slope drains shall be installed where groundwater weeping is encountered. Terraces are desirable on long or large fill slopes to break up surface flow. Wattles may be installed on the contour for long slopes to break up surface flow until vegetation is established.

<u>Soil stabilization measures must be initiated immediately</u> (i.e., same day) whenever any clearing, grading, excavating or other earth disturbing activities have temporarily or permanently ceased on any portion of the site and will not resume for a period exceeding 14 calendar days. Stabilization in these areas by vegetative or non-vegetative means must be <u>completed within 14 days</u>.

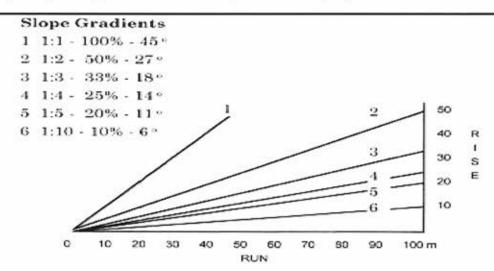
The following table includes suitable erosion control and stabilization measures that may be utilized on the site. Additional measures may be utilized upon permission from the Stormwater Compliance Manager and entry into the Site SWPPP Amendment Log. The measures presume that proper sediment control barriers will be utilized downgradient of work areas, at the Limit of Work.

Table 1.

Slope	Vegetative Stabilization Measure	Non-vegetative Stabilization Measure		
10H:1V (10%)	Loam & seed with sediment barrier, sod	Hay/straw mulch (2 bales/1,000 sf), hydromulch (min. 2,200 lbs/acre), bark mulch, stump grindings, poly, Rolled Erosion Control Products (RECPs)		
5H:1V (20%)	Loam & seed with sediment barrier, sod	Hay/straw mulch (2 bales/1,000 sf), hydromulch (min. 2,200 lbs/acre), bark mulch, stump grindings, poly, Rolled Erosion Control Products (RECPs)		
4H:1V (25%)	Loam & seed with sediment barrier, sod	Hay/straw mulch (2 bales/1,000 sf), hydromulch (min. 2,200 lbs/acre), bark mulch, stump grindings, poly, Rolled Erosion Control Products (RECPs)		
3H:1V (33%)	Hydroseed (seed, mulch + tackifier), sod Loam & seed with hay mulch or Rolled Erosion Control Product (RECP). Utilize slope interruption device (wattle or terracing) for longer slopes.	Hydromulch (min. 2,200 lbs/acre), bark mulch, stump grindings, poly, Rolled Erosion Control Products (RECPs), rip rap		
2H:1V (50%)	Bonded Fiber Matrix (BFM) hydroseed or loam and seed with Rolled Erosion Control Product (RECP). Sod. Utilize slope interruption device (wattle or	Bonded Fiber Matrix (BFM) hydromulch, bark mulch, stump grindings, poly, Rolled Erosion Control Products (RECPs), rip rap		

terracing) for longer slopes.

1H:1V (100%) Vegetative Stabilization not permissible. Rip Rap



<u>Driveway</u>, <u>Parking Areas & Utilities Construction</u>: The rough graded parking areas and driveways may be pitched slightly, as needed, to divert run-off into stabilized diversion swales and/or dikes. As necessary, temporary swales with check dams or dikes and settling basins may be utilized on house lots to contain and treat stormwater. After the utilities have been installed on a given lot, the driveways and parking areas will be immediately finish graded and stabilized with a binder coat of pavement.

<u>Inlet Protection</u>: All catch basin inlets located downstream of construction activities will be protected with maintained silt sacks, Sediguard device or sediment filter log/wattle. The inlet protection devices must be inspected weekly. The devices must be cleaned or replaced as sediment accumulates, the filter becomes clogged, and/or performance is compromised. Sediments accumulated adjacent to inlets must be removed immediately (i.e., by end of work day).

Treatment Chemicals / Flocculant Polymers:

Treatment chemicals and/or flocculant polymers are not proposed for use at the site; however, upon approval from the Stormwater Compliance Officer, anionic flocculant polymers may be prescribed and utilized, as necessary, to cause settling of suspended solids prior to discharge from the site. The flocculants must be selected by trained specialists (e.g., Hydrograss Technologies, N. Oxford, MA) to ensure that they are Anionic and suited to the site soil conditions and to the expected turbidity, pH, and flow rate of stormwater flowing into the chemical treatment system or area. Use conventional erosion and sediment controls prior to flocculant addition to ensure effective treatment. Flocculants may only be applied where treated stormwater is directed to a sediment control (e.g., sediment basin, perimeter control) prior to discharge.

The flocculants must be used in accordance with good engineering practices, and with dosing specifications and sediment removal design specifications provided by the provided/supplier of the chemicals, or document specific departures from these practices and how they reflect good engineering practice. All persons who handle and use the chemicals must be provided with appropriate, product specific training, including dosing requirements. Flocculants may be used as soil coatings (powder form) or as solid blocks within areas of concentrated flow, such as catch basins and swales. Care shall be taken to avoid flocculent log placement within unstable swales or conveyances to prevent coating/clogging with sediments. Flocculent systems shall be designed to trap/still effluents to provide for sediment fall-out upgradient of wetland areas.

No Cationic treatment chemicals shall be used at the site. Flocculants must be used under relevant state and local requirements and must be stored under storm resistant cover in leak proof containers and surrounded by secondary containment devices.

Dust Control:

The generation of dust must be minimized to avoid pollutants from being discharged into surface waters. As needed, dust control will be maintained by limiting soil exposure via the use of mulch, vegetative cover, or stone. As needed sprinkler, water truck applications may be used during grading to minimize airborne sediment transport. Repetitive treatments will be done as necessary until surfaces are paved or otherwise stabilized. Calcium chloride spray or chemical adhesive application shall only be used if other alternatives are deemed ineffective and upon approval from the local Conservation Commission.

Dewatering Practices:

Dewatering discharges from trenches or excavations are prohibited unless managed by appropriate controls. Uncontaminated, non-turbid dewatering water can be discharged without being routed to a control. Any turbid water that is pumped from a utility trench or other excavation on the project site shall be discharged into the uplands, away from wetland resources. The outlet of the discharge pipe shall discharge to non-erosive materials (e.g., stone) to avoid erosion. Alternatively, turbid water may be discharged into an infiltration/sediment basin, weir tank, filtration system, dewatering bag or equivalent product into an area surrounded by entrenched siltation fence and double-staked hay bales. If necessary, and upon approval from the Stormwater Compliance Officer, anionic flocculant polymers may be utilized, to cause settling of suspended solids prior to discharge from the site. Effluents shall be monitored for suspended sediments prior to entering wetlands.

2.4 Timing of Controls

As outlined in the Construction Sequence section, staked hay bale siltation barriers and stabilized construction entrances will be installed prior to any additional clearing and grubbing work. Appropriate temporary sediment basins, devices, diversions swales and associated siltation prevention measures shall be installed prior to site earth work commencing. Areas where construction will temporarily cease for more than 14 days will be hydroseeded, seeded and blanketed, or non-vegetatively stabilized immediately. Once construction activity ceases permanently, all areas will be stabilized with seed, mulch, landscaping, building, pavement or another such permanent stabilization measure.

2.5 Maintenance Requirements

Maintenance of erosion and sedimentation control measures is critical to their effectiveness. Maintenance of these measures will be an ongoing process during the period of construction and will continue until permanent vegetation has been established. The Construction Manager must ensure that all erosion and sediment controls remain in effective operating condition during permit coverage and are protected from activities that would reduce their effectiveness. All erosion and sediment controls must be inspected during the weekly site inspection. Inspection procedures are detailed in Section 6.0. If minor deficiencies are found repairs or modifications must be initiated immediately (same day) and completed within 1 day. When a new erosion or sediment control measure installation or major repair is required, it must be completed within 7 days from the time of discovery, where feasible, or document why the repair is infeasible in the SWPPP. If repairs or modifications result in substantial changes to stormwater controls or procedures in the SWPPP, the SWPPP must be modified to reflect said changes within 7 days of completing the work.

Section 3.0 Pollution Prevention Requirements

3.1 Construction Site Potential Pollutants

The following materials or substances are anticipated to be present on-site during the construction period:

Trade Name Material	Stormwater Pollutants (1)	Storage Requirements		
Fertilizer	Nitrogen, phosphorous	Under cover (roof or poly) from weather.		
Plaster	Calcium sulphate, calcium carbonate, sulfuric acid	Under cover (roof or poly) from weather.		
Cleaning solvents	Perchloroethylene, methylene chloride, trichloroethylene, petroleum distillates	Sealed, water tight container. Under cover (roof or poly) from weather.		
Asphalt	Oil, petroleum distillates	Under cover (roof or poly) from weather.		
Concrete	Limestone, sand	Under cover (roof or poly) from weather.		
Glue, adhesives	Polymers, epoxies	Sealed, water tight container. Under cover (roof or poly) from weather.		
Paints	Metal oxides, Stoddard solvent, talc, calcium carbonate, arsenic	Sealed, water tight container. Under cover (roof or poly) from weather.		
Hydraulic oil/fluids	Mineral oil	Sealed, water tight container. Under cover (roof or poly) from weather.		
Gasoline	Benzene, ethyl benzene, toluene, xylene, MTBE	Sealed, water tight container. Under cover (roof or poly) from weather.		
Diesel fuel	Petroleum distillate, oil and grease, naphthalene, xylenes	Sealed, water tight container. Under cover (roof or poly) from weather.		
Antifreeze/coolant	Ethylene glycol, propylene glycol, heavy metals (copper, lead, zinc)	Sealed, water tight container. Under cover (roof or poly) from weather.		

⁽¹⁾ Data obtained from MSDSs when available

3.2 Pollution Prevention Standards

Permittees are required to design, install and maintain effective procedures and controls to minimize the discharge of pollutants. You must inspect all pollutant generating activities and pollution prevention controls in accordance with your inspection frequency requirements to avoid leaks or spills in stormwater discharges and must document your findings in the Inspection Report. Minor repairs or replacement of deficient controls must be initiated immediately (same day) and completed within 24 hours for minor. Significant repairs or replacements must be initiated immediately and completed within 7 days.

Prohibited discharges include:

- Wastewater from washout of concrete, unless managed by an appropriate control (see attached concrete washout BMP)
- Wastewater from washout and cleanout of stucco, paint, form release oils, curing compounds and other construction materials;
- Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance;
 and:
- Soaps or solvents used in vehicle and equipment washing;
- Toxic or hazardous substances from a spill or other release.

Equipment/Vehicle Fueling and Maintenance Practices:

Large equipment will be fueled by over the road fuel trucks. Small equipment will be fueled using approved 5 gallon containers or fitted pickup truck fuel tanks. All equipment shall be fueled outside of the 100 foot Buffer Zone, or as far from wetland resource areas as practicable. Fueling areas will be inspected immediately for signs of leaks or spills. Spill kits shall be kept on site and readily available. Drip pans or absorbents shall be used under known leaky vehicles. Do not clean surfaces by hosing down a spill area. Discovered spills shall be dealt with as outlined in Section 5.3 Spill Control Practices below.

Equipment/Vehicle Washing:

No heavy equipment/vehicle washing will be allowed on-site unless to hose off sediments to prevent vehicle track-out onto public roads. No soaps or detergents shall be used. Wash waters from equipment and vehicle washing, wheel wash water, and other wash waters must be treated in a sediment settling basin or alternative control that provides equivalent or better treatment prior to discharge. Hosing shall not occur near a surface water, catch basin or other conveyance. Construction equipment will be parked/staged within designated areas outside of the Buffer Zone, or as far away from wetland resource areas as practicable.

Storage, Handling, and Disposal of Construction Products, Materials, and Wastes:

<u>Building Products:</u> including but not limited to asphalt sealants, copper flashing, roofing materials, adhesives, concrete admixtures, must be stored under cover from weather by roof or plastic sheeting.

<u>Pesticides</u>, <u>insecticides</u>, <u>insecticides</u>, <u>fertilizers and landscape materials</u> Pesticides and/or herbicides of any type shall not be used for the establishment or maintenance of landscape plantings or lawns on the site, per the Holliston Conservation Commission. Use of fertilizers

shall be limited to low phosphorus, organic-based fertilizers. Fertilizer storage will be done in sealed bins under cover from weather. Fertilizers shall be stored outside of the 100 foot Buffer Zone, or as far away from wetland resources as practicable.

<u>Diesel fuel</u>, oil, hydraulic fluids, other petroleum products must be stored in water tight containers under cover from weather by roof or plastic sheeting. Spills must be cleaned immediately using dry clean-up methods where possible and dispose of used materials properly. Do not clean surfaces or spills by hosing the area down. Eliminate the source of the spill to prevent further release.

Hazardous or toxic waste:

Hazardous and toxic waste materials including but not limited to: paints, solvents, petroleum based products, wood preservatives, additives, curing compounds, and acids shall be separated from construction and domestic waste and stored in sealed containers constructed of suitable materials to prevent leakage and corrosion and labeled in accordance with applicable RCRA and other regulatory requirements. Materials may not be stored outside and must be stored under cover from weather in appropriate containers. All hazardous waste materials (i.e. petroleum products, solvents, etc.) will be disposed in accordance with applicable federal, state and local regulations and by the manufacturer. Individuals working on the site will be informed of the appropriate procedure for waste disposal. Spills must be cleaned immediately using dry clean-up methods where possible and dispose of used materials appropriately (see above). Do not clean surfaces or spills by hosing down the area. Eliminate the source of the spill to prevent further release. The construction manager will be responsible for seeing that these procedures are followed properly.

Construction and domestic waste:

All construction and domestic waste materials, including but not limited to packaging, scrap construction materials, masonry, timber, pipe, electrical, plastics, Styrofoam and concrete will be collected and stored securely in metal dumpsters leased from a licensed solid waste management company. The dumpster will meet local and state solid waste management regulations and will be emptied as necessary. A licensed company in accordance with applicable federal, state and local regulations will transport the trash. No trash or construction debris will be buried on site. Individuals working on the site will be informed of the appropriate procedure for waste disposal. The construction manager will be responsible for seeing that these procedures are followed properly.

Sanitary Waste:

Portable toilets shall be positioned so they are secure, stable and cannot tip over. All sanitary waste will be collected from portable units by a licensed contractor in a timely manner and disposed in compliance with federal, state and local regulations.

Washing of Applicators and Containers used for Paint, Concrete, or Other Materials:

The discharge of wastewater from washout of concrete, paint, stucco or other materials is prohibited, unless managed by an appropriate control. Discharges must be to designated polylined excavated basins, or poly-lined hay bale enclosures, either covered or designed so that no overflows can occur due to inadequate sizing or precipitation. Concrete specific washouts will

be allowed to cure. Once cured, the concrete will be broken up and used as building borrow or hauled off site as needed (see appended concrete washout BMP). Other liquid wastes must be disposed of in accordance with the manufacturer's recommendations and in compliance with local, state, federal and tribal regulatory requirements.

3.3 Emergency Spill Notification

In addition to the measures outlined above, the following practices will be followed for spill prevention and cleanup.

- Materials and equipment necessary for cleanup of a spill will be kept in adequate supplies
 on site in a designated storage area. Equipment is not limited to, but will include shovels,
 wheel barrows, brooms, dust pans, mops, rags, gloves, safety eyewear, Speedi-dry
 absorbent material, sand, sawdust, plastic and metal trash bins reserved specifically for
 this type of cleanup.
- All spills will be removed immediately after discovery using dry clean up measures where possible, and eliminate the source of the spill to prevent further spill release.
- 3. Spills of toxic or hazardous material will be immediately reported to the Emergency Response Section of the Massachusetts Department of Environmental Protection at 1-888-304-1133. Additionally, notice must be provided to the National Response Center (NRC) at 800-424-8802 in accordance with the NPDES requirements as soon as site staff have knowledge of the discharge.
- 4. In the event of a spill, the spill prevention plan will be adjusted accordingly to prevent a future spill of the same nature. A description of the spill, the cause and the removal measures should be documented in the event of a spill.
- The construction manager will be the spill prevention and cleanup coordinator. He or she will be responsible for educating the construction personnel of the protocol in the event of a spill.

3.4 Fertilizers Discharge Restrictions

Fertilizers containing nitrogen or phosphorus shall be used minimally at the site. It is recommended that high quality, organically rich top soil and a mulching medium (e.g., hydromulch) is used to ensure proper germination and growth of grass seed and other plantings. If used, fertilizers shall be applied at the manufacturer's specified rate, and time of year application. Fertilizers shall not be applied before heavy rains, onto frozen ground, or within stormwater conveyance channels, systems or within flowing water. All local, state, federal and tribal requirements regarding fertilizer shall be followed.

3.5 Non-Stormwater Discharges

To the extent practicable, non-stormwater discharges will be directed to vegetated surfaces and/or detention basins prior to discharge to wetlands and/or waterways.

Type of Allowable Non-Stormwater Discharge	Likely to be Present at Your Site?		
Discharges from emergency fire-fighting activities	☐ YES ☑NO		
Fire hydrant flushings	☑YES ☐ NO		
Landscape irrigation			
Waters used to wash vehicles and equipment	☐ YES ⊠NO		
Water used to control dust	☑YES ☐ NO		
Potable water including uncontaminated water line flushings	☑ YES ☐ NO		
Routine external building wash down	☐ YES ⊠NO		
Pavement wash waters	☐ YES ☒ NO		
Uncontaminated air conditioning or compressor condensate	☐ YES ☒ NO		
Uncontaminated, non-turbid discharges of ground water or spring water	☑ YES ☐ NO		
Foundation or footing drains	☑ YES ☐ NO		
Construction dewatering water	☑ YES ☐ NO		

Section 4.0 Site Inspection and Corrective Action Procedures

4.1 Inspection Personnel

The Construction Manager will be responsible for conducting and documenting construction inspections in accordance with the above described inspection schedule. Alternate qualified individuals are listed below with contact information. All personnel conducting inspections must be considered a "qualified person." CGP Part 4.1.1 clarifies that a "qualified person" is a person knowledgeable in the principles and practices of erosion and sediment controls and pollution prevention, who possesses the skills to assess conditions at the construction site that could impact stormwater quality, and the skills to assess the effectiveness of any stormwater controls selected and installed to meet the requirements of this permit. The below have read and understand the terms and conditions of the SWPPP, are trained in the implementation of the Best Management Practices (BMPs) described in the SWPPP, and are prepared to prescribe BMP corrective actions when necessary:

Ron Ringgard	Scott Jordan, CPESC	Scott Morrison, RPSS
Arboretum Village LLC	EcoTec, Inc.	EcoTec, Inc.
31 Gallair Circle	102 Grove Street	102 Grove Street
Holden, MA 01520	Worcester, MA 01605	Worcester, MA 01605
508-829-0676	(508) 752-9666	(508) 752-9666
Cell (774) 696-2204	Cell (508) 328-6640	Cell (508) 328-5935

The following individual(s) are duly authorized individuals and have been delegated the authority to sign inspection reports. Please see the attached signed delegation of authority form(s):

1) 2)

4.2 Site Inspection Schedule

The construction manager or other qualified individual will conduct site inspections every 7 days.

Rain Gauge Log:

It is recommended that a rain gauge is properly maintained at the site to determine rainfall amounts. The rain gauge must be checked and emptied daily and results entered into the appended Rain Gauge Log. The location of the rain gauge shall be in an open area adjacent to the construction trailer/building. Alternatively, storm event information may be obtained from a weather station that is representative of your location (e.g., National Weather Service for Boston, http://www.erh.noaa.gov/box/dailystns.shtml).

Reduced Site Inspection Frequency:

Site inspection frequency may be reduced to once per month for portions of the site where vegetative or non-vegetative stabilization activities have been completed (e.g., hydroseeded, mulched). These areas must be identified on the site plan drawing and referenced on the Site Inspection Report and Grading and Stabilization Activities Log.

During frozen winter conditions, inspections may be performed at least once every month while the ground is frozen provided that runoff is unlikely due to continuous frozen conditions (i.e., daytime high temps below 32) are likely to continue for at least 3 months, and except for active earth work areas, disturbed areas have been temporarily or permanently stabilized. Inspections frequency will re-commence to weekly upon thawing conditions (i.e., daytime highs >32 degrees for 2 or more days).

4.3 Inspection Reports and Procedures

Maintenance of erosion and sedimentation control measures is critical to their effectiveness. Maintenance of these measures will be an ongoing process during the period of construction and will continue until permanent vegetation has been established. Inspection and maintenance of the erosion and sedimentation control measures discussed in this plan will be the responsibility of the proponent, although other parties may carry out inspection and maintenance activities at the direction of the proponent.

Areas That Need to be Inspected:

During the site inspection, unless deemed unsafe, you must at a minimum inspect the following areas:

- All unstable cleared, graded, or excavated areas;
- · All stormwater controls, including pollution prevention measures;
- Material, waste, borrow or equipment storage and maintenance areas;
- All areas where stormwater flows within the site, including swales, diversion ditches, conveyance channels;

- · All discharge points from the site; and
- · All locations where stabilization measures have been implemented (may be monthly).

Requirements for Inspection:

During your site inspection you must at a minimum:

- Check all erosion and sediment controls and pollution prevention controls to ensure that
 they are installed, appear to be operational, and are working as intended to minimize
 pollutant discharges. Determine if controls need to be replaced, repaired or maintained;
- Check for the presence of conditions that could lead to spills, leaks or other accumulations of pollutants on the site;
- Identify any locations where new or modified stormwater controls are necessary based upon current conditions and flow paths;
- Check for signs of erosion and sediment deposits at discharge points that are attributable to your site discharges;
- · Identify any incidents of noncompliance observed;
- If a discharge is occurring during your inspection, you must identify all discharge points
 observed on the property; document the visual quality of the discharge (color, odor,
 floating, settled, suspended solids/turbid, foam, oil sheen, etc.); and document whether
 stormwater controls are operating effectively and as intended or are in need of
 modification or maintenance.

Inspection Report:

The **Site Inspection Form** for the site is appended. You must complete an inspection report within 24 hours of completing the site inspection. You are required to keep a current copy of all inspection reports at the site or at an easily accessible location. Inspection reports may be kept electronically if they are readily accessible during an EPA inspection. Each report must include:

- The inspection date;
- Name(s) and title(s) of personnel making the inspection;
- · A summary of your inspection findings and observations;
- If inspection is a rain event triggered inspection, you must include the rain gauge or weather station readings that triggered the inspection;
- If you have determined that any portion of the site is unsafe to inspect, you must document the locations and conditions.
- Each Inspection Report must be signed by the Construction Manager.

4.4 Corrective Action Procedures

Corrective Actions are actions taken to correct identified deficiencies in order to comply with the 2012 CGP and may include:

- Repair, modification, or replacement of any stormwater control at the site;
- · Clean up and proper disposal of spills, releases, or other deposits, or
- Remedy of a permit violation.

The site Construction Manager shall be responsible for ensuring that all identified Corrective Actions

are completed and documented in accordance with the Requirements.

Requirements for Taking Action:

Upon identification of a missing, or ineffective stormwater control, or prohibited site discharge, you must immediately (same day) take all reasonable steps to minimize or prevent the discharge of pollutants until a permanent solution is installed and made operational, including clean-up of any contaminated surfaces. For repairs that are deemed minor in complexity, repairs or modifications must be completed within 24 hours. For significant or complex repairs, new or modified controls must be operational and completed within 7 calendar days of discovery. If it is infeasible to complete the installation or repair within 7 days, you must document in your records why it is infeasible and your schedule for completing as soon as possible.

Corrective Actions and SWPPP Modification:

Where your corrective actions result in changes to any of the stormwater controls or procedures documented in your SWPPP, you must modify your SWPPP accordingly within 7 calendar days of completing the corrective action work.

4.5 Corrective Action Reports

For each corrective action taken the Construction Site Manager must complete a copy of the appended **Corrective Action Report**. You are required to keep a current copy of all corrective action reports at the site or at an easily accessible location. Reports may be kept electronically if they are readily accessible during an EPA inspection.

Within 24 hours of discovering the occurrence of a condition requiring a corrective action, you must complete a report of the following:

- Condition identified at the site and the nature of the condition;
- The date and time of the condition identified and how it was identified.

Within 7 calendar days of discovering the occurrence of a condition requiring a corrective action, you must complete a report of the following:

- Any follow up actions taken to review the design, installation, and maintenance of stormwater controls and the dates of such actions;
- A summary of stormwater control modifications taken or to be taken, including a schedule of activities necessary to implement changes, and the date the modifications are completed or expected to be completed; and
- Notice of whether SWPPP modifications are required as a result of the condition identified or corrective action.

4.6 Logs and Record Keeping Requirements

The SWPPP shall contain documentation and records for all erosion and sedimentation control activities at the site. Record keeping requirements for projects under Construction General Permit coverage shall include additions of new BMPs, replacement of failed BMPs, timing and dates associated with activities that disturb or stabilize soils on the project, changes in personnel, changes in inspection and maintenance procedures, the installation or construction of major

stormwater controls such as storm drain systems, headwalls, detention basins, outfall structures, slope and embankment activities, stream crossings, sit stabilization, foundation and trench dewatering activities, or updates to site maps (plan drawings).

Specifically required are records of the dates when construction activities (e.g., grading or earth disturbance) start within the individual project phases, dates when construction activities cease temporarily or permanently within a project phase and when temporary or permanent stabilization is initiated and completed within the project phases. The appended **Grading and Stabilization Activities Log** shall include the dates when construction activities (e.g., grading or earth disturbance) start within the individual project phases, dates when construction activities cease temporarily or permanently within a project phase and when temporary or permanent stabilization is initiated and completed within the project phases.

Additionally, rain gauge information shall be recorded on the appended Rain Gauge Log and kept at the site to document storm events.

The appended **SWPPP** Amendment Log serves as a log of changes and/or updates to the SWPPP and shall include additions of new BMPs, replacement of failed BMPs, significant changes in the activities or their timing on the project, changes in personnel, changes in inspection and maintenance procedures, or updates to site maps (plan drawings).

The above referenced logs must be readily available for review and retained with the SWPPP for at least three years form the date that the permit coverage expires and is terminated.

Section 5.0 Staff Training Requirements

5.1 Qualifying Personnel

Prior to the commencement of earth disturbing activities or pollutant generating activities, the Construction Manager and/or Compliance Officer shall conduct site specific stormwater training for all personnel and contractors engaged in construction related activities which may impact stormwater quality. Qualifying persons include:

- Personnel responsible for the design, installation, maintenance and or repair of stormwater controls;
- Personnel responsible for the application and storage of treatment chemicals and/or flocculants (if used at the site);
- · Personnel responsible for taking corrective actions.

New qualifying personnel shall be trained prior to assuming any of the above responsibilities.

5.2 Training Requirements

This training shall include, at a minimum:

 The location of all stormwater controls on the site required by the CGP and how they are maintained;

- The proper procedures to follow with respect to the permit's pollution prevention requirements;
- When and how to conduct inspections, record applicable findings, and take corrective actions.
- The obligation of each individual not to interfere with the effectiveness of the BMPs at the site and to identify BMP deficiencies and failures to the attention of the Construction Manager.

This training shall be documented on the appended SWPPP Training Log. You are not required to provide or document formal training for subcontractors or other outside service providers, but you must ensure that such personnel understand any requirements of the permit that may be affected by the work they are subcontracted to perform. The appended Subcontractor Certifications/Agreements form should be completed for those subcontractors who are engaged in activities that could impact stormwater (e.g., cement, excavators, sediment control installation contractors, etc.).

The above referenced logs must be readily available for review and retained with the SWPPP for at least three years form the date that the permit coverage expires and is terminated.

Section 6.0 Certification Statement and Signature

The following certification statement must be signed and dated by the site Operator. This certification must be re-signed in the event of a SWPPP modification.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Section 7.0 List of Appendices

Appendix A: N.P.D.E.S Notice of Intent (NOI) and EPA Authorization Email with

Tracking #

Appendix B: Site Street Map and USGS Topographic Map Loci

Appendix C: EPA Region 1: Massachusetts List of Approved TMDLs

Appendix D: Referenced Site Plans

Appendix E: U.S. Dept. of the Interior Fish and Wildlife Service Natural Resources of

Concern site map and list

Appendix F: Site Inspection Report form

Appendix G: Corrective Action Report form

Appendix H: SWPPP Amendment Log form

Appendix I: Rain Gauge Log form

Appendix J: Grading and Stabilization Log form

Appendix K: SWPPP Training Log form

Appendix L: Massachusetts Historical Commission – State Register of Historic Places 2010

Appendix M: Delegation of Authority form

Appendix N: Subcontractor Certifications/Agreements form

Appendix O: NPDES 2012 Construction General Permit

Appendix P: BMP Specification Sheet

Company: Arboretum Estates, LLC

ATTN: Steven Gallo

Sarah Dr.

Worcester MA 01607

Facility: Arboretum Village

Sarah Dr.

Worcester MA 01607

Permit Tracking Number: MAR12A693

Thank you for using the eNOI system to prepare your Construction General Permit (CGP) Notice of Intent (NOI).

This email/letter acknowledges that you have submitted a complete NOI form to be covered under the CGP. Your NOI form with permit tracking number MAR12A693 has been submitted to EPA. Coverage under this permit begins at the conclusion of your 14 day wait period on Tuesday, May 29, 2012, unless you are otherwise notified that a hold has been placed on your permit authorization. You will receive an email informing you of the date your coverage under the CGP is active.

If you have any questions, please call the EPA NOI Processing Center at 1-866-352-7755 (toll free) or send an email to noi@avanticorporation.com.

EPA NOI Processing Center Operated by Avanti Corporation 1200 Pennsylvania Ave., NW Mail Code: 4203M Washington, DC 20460 Company: Arboretum Estates, LLC

ATTN: Steven Gallo

Sarah Dr.

Worcester MA 01607

Facility: Arboretum Village

Sarah Dr.

Worcester MA 01607

Permit Tracking Number: MAR12A693

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EPA NOI Processing Center Operated by Avanti Corporation 1200 Pennsylvania Ave., NW Mail Code: 4203M Washington, DC 20460 NPDES FORM 3510-9



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY WASHINGTON, DC 20460 NOTICE OF INTENT (NOI) FOR STORMWATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITY UNDER AN NPDES GENERAL PERMIT

Form Approved. OMB Nos. 2040-2040

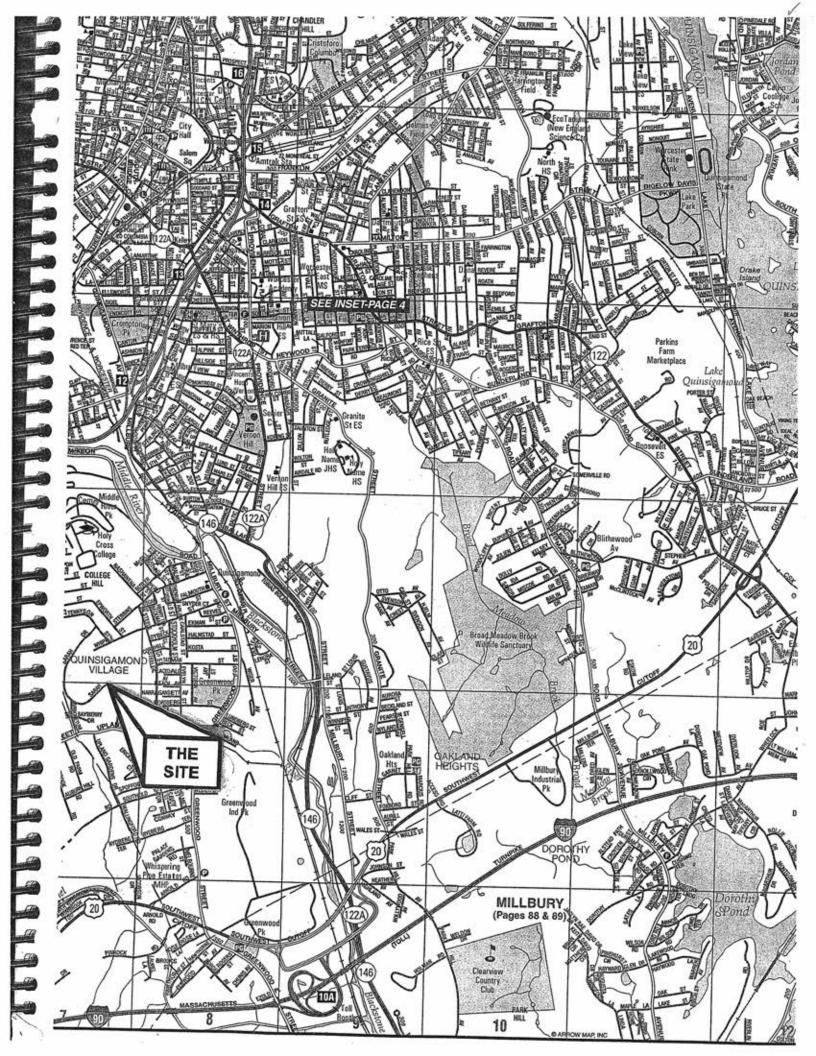
Submission of this Notice of Intent (NOI) constitutes notice that the operator identified in Section II of this form requests authorization to discharge pursuant to the NPDES Construction General Permit (CGP) permit number identified in Section I of this form. Submission of this NOI also constitutes notice that the operator identified in Section II of this form meets the eligibility requirements of Part 1.1.1 of the CGP for the project identified in Section III of this form. Permit coverage is required prior to commencement of construction activity until you are eligible to terminate coverage as detailed in Part 8 of the CGP. To obtain authorization, you must submit a complete and accurate NOI form. Discharges are not authorized if your NOI is incomplete or inaccurate or if you were never eligible for permit coverage. Refer to the in structure in the insurance of the insurance

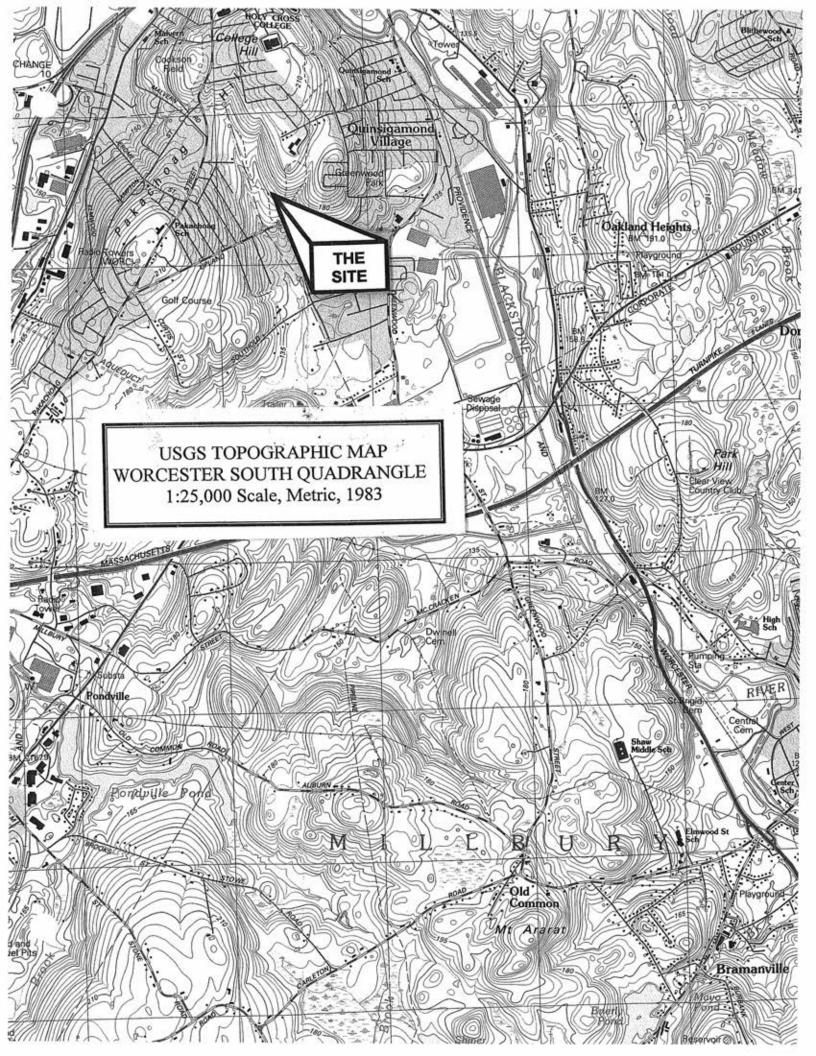
I. Approval to Use Paper NOI Form		
Have you been given approval from the R	regional Office to use this paper NO	Iform*?
If yes, provide the reason you need to u approval:	use this paper form, the name of the El	PA Regional Office staff person who approved your use of this form, and the date of
Reason for using paper form:		
Name of EPA staff person:		
Date approval abtained:		
* Note: You must have been given approval	by the Regional Office prior to using th	nis paper NOI form.
II. Permit Information:	Haracher Mark Andrews	Tracking Number (EPA Use Only) MAR12A693
Permit Number: MAR120000		(see Appendix B of the CGP for the list of eligible permit numbers)
III. Operator Information		
Name: Arboretum Estates, LLC		
Phone: 508-829-0676		Fax (Optional): 508-829-0681
.mail: sgallo@gallobuilders.com		
IRS Employer Identification Number (EIN)	:	
Point of Contact (First Name, Middle Initia	il, Last Name): Steven A Gallo	
Mailing Address:		
Street: 31 Gallair Cir.		
City: Holden	State: MA	Zip: 01520
NOI Preparer (Complete if NOI was prepar	red by someone other than the certi	fier):
Prepared by (First Name, Middle Initial, La	st Name): Scott M Morrison	<i>⊕</i>
Organization: EcoTec Inc.		
Phone: 508-752-9666		Fax (Optional): 508-752-9494
E-mail: smorrison@ecotecinc.com		
IV. Project/Site Information		
Project/Site Name: Arboretum Village		70 E
Project/Site Address:	*	
Street: Sarah Dr.	2	
ity: Worcester	State: MA	Zip: 01607
County or similar government subdivision	: Worcester	

For the project/site for you are seeki	ng permit coverage, provide the follow	wing information:			
atitude/Longitude (Use one of three	possible formats, and specify metho	d)			
Latitude 1, N(degrees, minutes, seconds)	Longitude	71.48.27	W(degrees, minutes, seconds)	
	degrees, minutes, decimal) degrees, decimals)			W(degrees, minutes, decimal) W(degrees, decimals)	
Latitude/Longitude Data Source:	U.S.G.S topographical	map EPA web site	☐ GPS	Other: Google Earth	
Horizontal Reference Datum:	■ NAD 27	■ NAD 83 or	WGS 84	Unknown	
Is your project/site located in Indian Country I tribe?	ands, or located on a property of religious or o	cultural significance to an India	n Yes	No No	
	ndian tribe associated with the area of Ir a Indian tribe associated with the proper		me of Indian res	servation, if applicable), or if not in Indian	
Are any of your activities for which you are re facilities" as defined in Appendix A?	questing coveraged under this NOI occurring	on areas considered "federal	Yes	✓ No	
Estimated Project Start Date: 03/01/20	06 Estimated Project Cor	npletion Date: 09/01/2014			
Estimated Area to be Disturbed (to the	e nearest quarter acre): 11.0				
Have earth-disturbing activities commenced of	on your project/site?		Yes	No No	
If yes, is your project an *emergency	-related project?		Yes	✓ No	
Have stormwater discharges from yo	our project/site been covered previously under	an NPDES permit?	Yes	□ No	
If yes, provide the Track individual permit: MAR10		r EPA's CGP or the NPD	ES permit num	ber if you had coverage under an EPA	À
V. Discharge Information			SE SECTION		
Does your project/site discharge stormwater i (MS4)? Do any surface waters exist within or immedia construction activities will occur?	ately adjacent to the property on which the	Yes No		2.	
Receiving Waters and Wetlands Infor Surface water(s) to which discharge	Impaired Water	Listed Water Polluta	nt/e)	Source	_
unnamed tributary to Blackstone River	No No	Listed Water Poliuta	nusj	US EPA Watershed Assessment, Tracking and Environmental Results website	g.
Impaired Waters	•				ī
Describe the methods you used to comp	plete the above table:				
Are any of the surface waters to which y quality exceeds levels necessary to sup Resource Water)? (See Appendix F).	rou discharge designated by the state or port propagation of fish, shellfish, and w	tribal authority under its a ildlife and recreation in and	ntidegradation p d on the water) o	olicy as a Tier 2 (or Tier 2.5) water (water or as a Tier 3 water (Outstanding Natural	r
Yes 🛮 No					
If yes, name(s) of receiving wa	ater(s) and its designation (Tier 2, Tie	r 2.5 or Tier 3):			
VI. Chemical Treatment Informat	ion				
Will you use polymers, flocculants, or other tre	eatment chemicals at your construction site?	Yes No			
If yes, will you use cationic treatment chemica	Is* at your construction site?	Yes No			
If yes, have you been authorized to u	se cationic treatment chemicals by your appli	cable EPA Regional Office in a	advance of filing yo	our NOI*?	
If you have been authorized to use c appropriate controls and implementa	ationic treatment chemicals by your applicable tion procedures designed to ensure that your	EPA Regional Office, attach a use of cationic treatment chem	a copy of your auth nicals will not lead	norization letter and include documentation of to a violation of water quality standards.	16
Please indicate the treatment chemic	als that you will use:				

EPA Form 3510-9

 Note: You are ineligible for coverage under this permit unless you notify your applicable EPA Regional Office in advance and the EPA office authorizes coverage under this permit
after you have included appropriate controls and implementation procedures designed to ensure that your use of cationic treatment chemicals will not lead to a violation of water
quality standards. II. Stormwater Pollution Prevention Plan (SWPPP) Information Has the SWPPP been prepared in advance of filing this NOI? SWPPP Contact Information: First Name, Middle Initial, Last Name: Steven A Gallo Organization: Gallo Builders, Inc. Phone: 508-829-0676 Fax (Optional): 508-829-0681 E-mail: sgallo@gallobuilders.com VIII. Endangered Species Protection Using the instructions in Appendix D of the CGP, under which criterion listed in Appendix D are you eligible for coverage under this permit (only check 1 box)? Provide the basis for criterion selection listed in Appendix D (e.g., communication with U.S. Fish and Wildlife Service or National Marine Fisheries Service, specific study):US Fish & Wildlife Service IPaC - Information, Planning, and Conservation Systems website If you select criterion B, provide the Tracking Number from the other operator's notification of authorization under this permit: If you select criterion C, you must attach a copy of your site map (see Part 7.2.6 of the permit), and you must answer the following questions: What federally-listed species or federally-designated critical habitat are located in your "action area": What is the distance between your site and the listed species or critical habitat (miles): If you select criterion D, E, or F, attach copies of any letters or other communications between you and the U.S. Fish and Wildlife Service or National Marine Fisheries ervice IX. Historic Preservation Yes No Are you installing any stormwater controls as described in Appendix E that require subsurface earth disturbance? If yes, have prior surveys or evaluations conducted on the site have already determined historic properties do not exist, or that prior disturbances have precluded the existence of historic properties? (Appendix E, Step 2) Yes No If no, have you determined that your installation of subsurface earth-disturbing stormwater controls will have no effect on historic properties? Yes No (Appendix E, Step 3) If no, did the SHPO, THPO, or other tribal representative (whichever applies) respond to you within the 15 calendar days to indicate whether Yes the subsurface earth disturbances caused by the installation of stormwater controls affect historic properties? (Appendix E, Step 4) If yes, describe the nature of their response: Written indication that no historic properties will be affected by the installation of stormwater controls on the site Written indication that adverse effects to historic properties from the installation of stormwater controls can be mitigated by agreed upon actions No agreement has been reached regarding measures to mitigate effects to historic properties from the installation of stormwater controls Other X. Certification Information I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. First Name, Middle Initial, Last Name: Steven A Gallo Title: President Signature: Date: Tuesday, May 15, 2012 mail: sgallo@gallobuilders.com





Massachusetts Water Body	State of Massachusetts TMDL Web Site EXIT Disclaimer			to
Tater Body	Town(s)	Approv	val Pollution Typ	e # of
FY 11	-	Date		TMDL
Taunton River Watershed (20 segments) (PDF) (13 pp, 197K)	Dighton, East Bridgewater, Easton, Fall River, Foxborough, Freetown, Halifax, Hanson, Lakeville, Mansfield, Middleboro, Norton, Plainville, Plympton, Raynham, Seekonk, Sharon, Somerset, Stoughton, Taunton, West Bridgewater, Westport,	Jun 16 2011	, Bacteria^	20
Upper/Middle Charles	Whitman, and Wrentham			
	Medway, Millis, Needham, Waltham, Wellesley, and portions of E) Arlington, Ashland, Bellingham, Belmont, Boston, Brookline, Dedham, Dover, Foxborough, Franklin, Holliston, Hopedale,	Jun 10, 2011	Nutrients (phosphorus)	30*
200 00	Hopkinton, Lexington, Lincoln, Medfield, Mendon, Milford, Natick Newton, Norfolk, Sherborn, Walpole, Watertown, Wayland, Weston, Westwood, and Wrentham	, pi		
FY 10				
Narragansett/Mt. Hope Ba Watershed (7 segments) (PDF) (13 pp, 63K)	ay Attleboro, Dighton, Rehoboth, Seekonk, Swansea, Westport, and Fall River	Jul 21, 2010	Bacteria^	7
White Island Pond (2 segments) (PDF) (13 pp, 56K)	Plymouth and Wareham	Jul 20, 2010	Nutrients	2
FY 09	Rt			
e Cod (49 segments) F) (20 pp, 86K)	Barnstable, Bourne, Brewster, Chatham, Dennis, Eastham, Falmouth, Harwich, Mashpee, Orleans, Provincetown, Sandwich, Truro, Wellfleet, Yarmouth	Aug 28, 2009	Bacteria^	49
Three Bays Watershed (4 segments) (PDF) (19 pp, 85K)	Barnstable	Aug 28, 2009	Bacteria^	4*
Chatham Southern	Chatham	l 00		
mbayments (8 segments) PDF) (16 pp, 121K)		Jun 22, 2009	Nutrients (Nitrogen)	8
Buzzards Bay (52 egments) (PDF) (21 pp, 24K)	Bourne, Dartmouth, Fairhaven, Falmouth, Marion, Mattapoisett, New Bedford, North Falmouth, Wareham, Westport	May 15, 2009	Bacteria^	52
lantucket Harbor Bay system (2 segments)	Nantucket			2
PDF) (15 pp, 100K) Y 08		2009	(Nitrogen)	
lyster Pond System (PDF) 4 pp, 117K)	Falmouth	May 5,		1
	Mashpee, Barnstable, Sandwich	2008	(Nitrogen)	
ystem (6 segments) PDF) (13 pp, 97K)	mashpee, barristable, Sandwich	May 5, 2008	Nutrients (Nitrogen)	6
				Í
PARTIE NO DE LA CONTRACTOR DE LA CONTRAC	Rarnetable Conduish Mark		(Nitrogen) Nutrients 6	3*

pp, 79K)	(14 Bourne, Sandwich	Feb 5	, Nutrients	1*
pponesset Bay (5	Mashpee, Barnstable, Sandwich	2008		
segments) (PDF) (15 p	p,	Jan 2 2008	2, Nutrients (nitrogen)	5
Centerville River - Eas	at Barnstable			
Bay System (PDF) (13 81K)		Dec 2 2007	0, Nutrients (nitrogen)	1*
Quaboag Pond and	Spencer and Brookfield			
Quacumquasit Pond (P (12 pp, 127K)	DF)	Dec 6, 2007	Nutrients (Phosphoru	1° s)
Waquoit Bay System (5 segments) (PDF) (14 pp 82K)		Nov 7, 2007	Nutrients (nitrogen)	5
Pleasant Bay System (1	6 Brewster, Chatham, Harwich, Orleans			
segments) (PDF) (19 pp, 82K)		Oct 24, 2007	, Nutrients (nitrogen)	16*
Lower Charles River (PI	OF) Arlington, Ashland, Bellingham, Belmont, Boston, Brookline,			
(29 pp, 142K)	Cambridge, Dedham, Dover, Foxborough, Franklin, Holliston, Hopedale, Hopkinton, Lexington, Lincoln, Medfield, Medway, Mendon, Milford, Millis, Natick, Needham, Newton, Norfolk, Quincy, Sherborn, Somerville, Walpole, Waltham, Watertown, Wayland, Wellesley, Weston, Westwood, Wrentham	Oct 17, 2007	Nutrients (phosphorus	1
FY 07	westwood, Wrentham			
Great, Green, and Bourn	es Falmouth, Sandwich, Mashpee, and Bourne			
Linbayment Syster	<u>ns</u>	Jul 18,	Nutrients	5
(5 segments) (PDF) (15 p 86K)		2007	(nitrogen)	
Charles River Watershed	Arlington, Ashland, Bellingham, Belmont, Boston, Brookline,			
(20 segments) (PDF) (22 pp, 166K)	Hopedale, Hopkinton, Lexington, Lincoln, Medfield, Medway, Mendon, Milford, Millis, Natick, Needham, Newton, Norfolk, Quincy, Sherborn, Somerville, Walpole, Waltham, Watertown	May 22, 2007	Bacteria	20
FY 06	Wayland, Wellesley, Weston, Westwood, Wrentham		7.	
Kickemuit River Watershe (PDF) (15 pp, 104K)	gSwansea, Rehoboth	Sep 28,	Bacteria	1
Chatham (PDF) (13 pp, 54K)	Chatham	2006	*******	
Y 05			(nitrogen)	12*
rost Fish Creek	Chatham			
			Bacteria	1
luddy Creek	Chatham, Harwich	2005	-	
Y 04		Apr 28, 1 2005	Bacteria	1
ssabet River (7	Westborough, Stow, Northborough, Acton, Marlborough, Berlin,	166		
	Hudson, Maynard, Concord, Shrewsbury, Sudbury		Nutrients 7	7
an 111ver (15	Rehoboth, Swansea	2004	8 5 5	
eg (s) Y03		Sep 22, E 2004	Bacteria 1	3
		590		

Millers Basin Lakes (28 segments)	Royalston, Gardner, Templeton, Petersham, Athol, Winchendo Westminster, Ashburnham, Rindge, Philipston,	n, Feb 05 2003	, Nutrients	28
tle Harbor	Cohasset	70 - 174777 403		
Ch	E.		, Bacteria	1
Shawsheen River (16 segments)	Lawrence, North Andover, Andover, Tewksbury, Wilmington, Billerica, Bedford, Burlington, Concord, Lincoln, Lexington		, Bacteria	16
French Basin Lakes (22 segments)	Charlton, Oxford, Leicester, Dudley, Spencer,	2002 Jul 12,	Nutrients	22
Flint Pond	Grafton, Worcester, Shrewsbury	2002		
Indian Lake	Non-Marchine Annie Annie	Jun 28, 2002	Nutrients	1
maran cano	Worcester	Jun 28,	Nutrients	1
Lake Boon	Hudson, Stowe	2002		
N,		Jun 28,	Nutrients	1
Lake Quinsigamond	Shrewsbury, Worcester	2002 Jun 28,	N	
Leesville Pond		2002	Nutrients	1
assestmen ond	Auburn, Worcester	Jun 28,	Nutrients	1
Salisbury Pond	Worcester	2002	THE RESERVE THE PARTY.	•
3883	200000000000000000000000000000000000000	Jun 28,	Nutrients	1
Neponset River (20	Boston, Dedham, Dover, Foxborough, Medfield, Milton, Quincy,	2002	D	
Segments)	nangoinn, Sharon Stoughton Wal-al- W.	Jun 21, 2002	Bacteria	20
(16 segments)	s Auburn, Leicester, Millbury, Shrewsbury, Worcester	May 02,	Nutrients	16
C pee Lakes (7	Ludlow, Oakham, Spencer, Springfield, Wibraham, West	2002		
segments)	Brookfield Brookfield, Wibraham, West		Nutrients	7
Connecticut Lakes (6	Hadley, Grandby, Leverett, Springfield, Shutesbury	2002 Apr 12,	Nicotal a set	-
segments) FY 00	A 8 2000	2002	Nutrients	6
D	Harvard			
1.3	· Idiyala	Nov 02, 1	Nutrients	1
2013		1999		



U.S. Fish and Wildlife Service

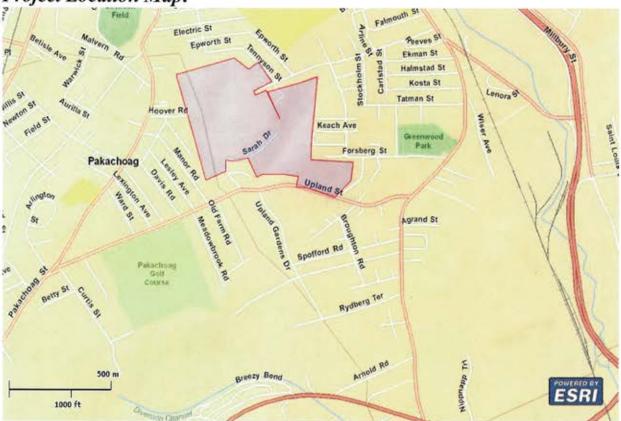
Natural Resources of Concern

This resource list is to be used for planning purposes only — it is not an official species-list.

Endangered Species Act species-list information for your project is available online and listed below for the following FWS Field Offices:

NEW ENGLAND ECOLOGICAL SERVICES FIELD OFFICE 70 COMMERCIAL STREET, SUITE 300 CONCORD, NH 3301 (603) 223-2541 http://www.fws.gov/newengland

Project Location Map:



U.S. Fish and Wildlife Service



Natural Resources of Concern

Project Counties:

Worcester, MA

Geographic coordinates (Open Geospatial Consortium Well-Known Text, NAD83):

MULTIPOLYGON (((-71.8100484 42.2301451, -71.8066152 42.2310464, -71.8057569 42.2304456,

- -71.805199 42.2308318, -71.8043836 42.2298018, -71.8054565 42.2292868, -71.8053706 42.2290723,
- -71.8047269 42.2293298, -71.8039115 42.2278277, -71.8046411 42.2292439, -71.802624 42.2297589,
- -71.8016799 42.2300593, -71.8020232 42.226669, -71.8020661 42.225639, -71.7995771 42.2255103,
- -71.7997058 42.2245232, -71.8006499 42.223622, -71.8023236 42.224137, -71.8029245 42.2241799,
- -71.8027957 42.2247378, -71.8037398 42.2248666, -71.8048986 42.2248666, -71.8052848 42.2246949,
- -71.8057998 42.2257249, -71.8063577 42.2255961, -71.8067439 42.2255532, -71.8071302 42.2255961,
- -71.8071302 42.2249953, -71.8082889 42.2245232, -71.8100484 42.2301451)))

Project Type:

Development

Endangered Species Act Species-list

There are no listed species found within the vicinity of your project.

FWS National Wildlife Refuges

There are no refuges found within the vicinity of your project.

FWS Migratory Birds

Not yet available through IPaC.

FWS Delineated Wetlands

Not yet available through IPaC.

Site Inspection Report

Site name:	Permittee	e:				
nspection date:	_ Inspecto	r Name/Title:				
W eather conditions (circle on	e): Dry	Rain		s	now	Icy
nspection type (circle one):	Regular	Precipitation (how	much	/sourc	e)	
	General		Yes	No	N/A	Responsive Action Log

	General	Yes	No	N/A	Responsive Action Log Reference #
A.	Is the Stormwater Pollution Prevention Plan ("SWPPP") on Site or its location posted?				
B.	If required under the applicable stormwater permit, is the applicable permit and/or NOI on Site?		9		
C.	Is contact information provided on Site and is it correct?				- N. C 11 11 11 11
D.	Since the last Site inspection, have there been any Government Inspections of the Site?				
E.	Was the Site Inspection Report for the last inspection signed by the site's Construction Manager?				TOTAL CONTRACTOR OF THE PARTY O
F.	Have Action Items from the last Site Inspection been addressed? If not, describe why not on Responsive Action Log for this Site Inspection.				
	Maintenance	Yes	No	N/A	Corrective Action Report Reference #
G.	Is there excess sediment or an excess of other pollutants exiting the Site?				
H.	Are on-site and off-Site roads/gutters free of excessive sediment from the Site?				
I.	Are exit/entrance controls properly located, in working condition, and no repairs necessary?				
J.	Are exposed areas not to be worked for 7 days stabilized as required?				
K.	Are stockpiles located and stabilized or contained as required?				
L.	Are BMPs properly located, in working condition, and no repairs necessary?				
M.	Are washouts properly located, in working condition, and no repairs necessary?				
NI.	Are fuels and hazardous materials stored under cover and managed as required?				293.0
Ο.	Are trash, construction debris, and other solid wastes managed as required in dumpsters?				
Ρ.	Are portable toilets provided, secured and properly located?				
Q.	Are the Site Stormwater BMPs installed, effective and consistent with the SWPPP?				

BMP Installation Documentation (New and/or Repaired BMPs)	Yes	No	N/A	Comments
R. Are there any new or repaired BMPs installed on the site since the last inspection?			16386754E	BACKS STATES OF THE STATES
S. If yes to R., What are the new/repaired BMPs on the site and when and where were they installed? (reference site plans if possible for BMP location(s))				
T. Is the new/repaired BMP installed in accordance with an approved BMP spec sheet?				
U. If a permanent structural BMP (e.g., retention basin, water quality swale) was the BMP installed in accordance with the engineered plans?		\$5		r.
V. Were the BMP materials in good condition prior to and during installation?				
Name and Title of Inspector:				
Signature: Date:	- 4		<u>2</u> 3	
Name and Title of Certifying Party:	-			

If a Designee conducts a Site Inspection, the Construction Manager must review and certify the Site Inspection Report. The Construction Manger for the Site certifies to the following statement:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Corrective Action Report

Da	ate:	
a Corrective A	ction, you must co	omplete the following:
	ouon, you must o	Has Corrective Action Been Initiated -
Condition Identified	Person Identifying Condition	explain
	a Corrective A	Condition Person Identifying

Within 7 calendar days of observing a condition requiring a Corrective Action, you must complete the following:

Summary of Corrective Action completed (modifications, repairs, replacement)	Date Completed or Schedule	Person(s) Completing Corrective Action	Any follow up actions taken to review stormwater procedures.	Does Corrective Action require SWPPP Modification? Is Modification completed?
	-			

11/ESC/CorrectiveActionReport2012

SWPPP Amendment Log

Amendment No.	Description of Amendment	Amendment Date	Prepared by [Name, Title]
	*		
		*	
+			
			31

Rain Gauge Log

Date / Time:	Logged By:	Gauged Rainfall (in):	Rain Gauge Emptied: Y/N	Approximate Rainfall Duration: Date(s) and Start / End Time of Rainfall
				5
			*	
				-181
				St. 100 100 100 100
				9

Grading and Stabilization Activities Log

Project Name: SWPPP Contact:

Date Grading Activity Initiated	Description of Grading Activity	Date Grading Activity Geased (Indicate: Temporary or	Date When Stabilization Measures are Initiated	Description of Stabilization Measure and Location
		Rermanent)		
			1	
*		45 4 5 18 4 2 11 1 1		
	• • • •	· · · · · · ·		
			e en generale. Hernogen and	
		* * * * * * * * * * * * * * * * * * * *		
Walter House				
-				

SWPPP Training Log

Stormwater Pollution Prevention Training Log

Proje	ect Name:				
Proje	ect Location:				
Instru	uctor's Name(s):				
Instru	uctor's Title(s):				
Cour	se Location:			Date:	
Cour	se Length (hours):			_	
Storr	mwater Training Topic: (check	k as ap	propriate)		
	Erosion Control BMPs		Emergency Procedu	res	
	Sediment Control BMPs		Good Housekeeping	BMPs	
	Non-Stormwater BMPs				

	dee Roster: (attach additiona	ai page.	Street Street		
No.	Name of Attendee		Com	pany	
1					
3					
4		_			
5				***************************************	
6					
7				×	
8					
9					
10	A				

Attleboro

Town/Name/Address	Designation		# Props
Attleboro (cont.)			
MATERIAL MATERIAL		35.3	
Knoll C Archaeological Site	NRDOE	10/15/198	1 1
Makepeace, D. E. Company 46 Pine St	NRIND	07/18/198	5 1
Northbound Railroad Station 1 Mill St	NRIND	01/05/1989	9 1
Robinson, Capt. Joel House 111 Rocklawn Ave	NRIND	11/20/1978	3 1
Sadler, Herbert Austin House 574 Newport Ave	NRIND	10/21/1982	2 1
Southbound Railroad Station 3 Mill St	NRIND	01/05/1989) 1
U. S. Post Office - Attleboro Main Branch 75 Park St	NRIND	10/19/1987	1
Auburn			
	*** *******************	Till Samuel Samuel	
Goddard Rocket Launching Site		11/13/1966	
Pakachoag Hill	NHL	11/13/1966	1
Stone, Joseph House 35 Stone St	NRIND	01/09/1986	1
Tuttle Square School	NRIND	03/08/2002	1
41 South St			4 (50
Avon			
Field, D. W. Park (Avon/Brockton) Between Pond and Pleasant Sts	NRIND	11/24/2000	136
Ayer			
*	· · · · · · · · · · · · · · · · · · ·		
Ayer Main Street Historic District Main St roughly between Park and Columbia Sts	NRDIS	03/16/1989	22
Parama Maria 1723	WDDTG.	03/16/1989	
Ayer Town Hall 1 Main St		09/18/2000	
	Exp:	-2, 20, 2000	
Community Memorial Hospital 15 Winthrop Ave	NRIND (05/14/2004	3

	£2				
		Designation	n Date	#	Props
**					
Wo	burn (cont.)				
	t a			_	
	Main Street Diner		11/22/200		
9	Diners of Massachusetts Multiple Property Submission, 901 Main St	NRMPS	11/22/200	U	
	Middlesex Canal	NRDIS	08/21/197	2	14
	*		11/19/200		
	Middlesex Canal Historic and Archaeological District (Billerica / Boston (Charlestown) / Chelmsford / Lowell / Medford / Somerville / Wilmington / Winchester / Woburn) Running	NRDIS	11/19/200	9	153
	southeast between the Merrimac River, Lowell as the Charles River, Boston	nd			
	Rumford, Count Birthplace	NHL	05/15/197	5	1
	90 Elm St		05/15/197		
	U. S. Post Office - Woburn Center Station	NŖIND	10/19/198	7	1
	2 Abbott St				
	Woburn Public Library	NRIND	11/13/197	6	2
	(Winn Memorial Library) Pleasant St	NHL	12/23/198	7	2
Wo	rcester				
3	Abbott Street Schoolhouse	NRIND	03/05/198	0	1
	36 Abbott St		03/05/198		
	Adams, Elwood Hardware Store	NRIND	03/05/198	0	1
- 7	156 Main St		03/05/198		
	Adriatic Mills	NRIND	03/05/198	0	1
	3-35 Armory St		03/05/198		
	Ahern, Catherine Three-Decker	NRIND	02/09/199	0	1
	215 Cambridge St		02/09/199		1
	Alexander, Arad House	NRIND	03/05/198	0	1
	53 Waverly St	NRMRA	03/05/198	0	1
Œ	Allen, Charles House	NRIND	03/05/198	0	1
	65 Elm St	NRMRA	03/05/198	0	1 .
	American Antiquarian Society	NRIND	11/24/196	8	1
eë.	185 Salisbury St	NHL	11/24/196	8	
	38	LHD	09/02/197	5	1
	Anderson, Ludwig Three-Decker	NRIND	02/09/1990	0	1
	4 Fairbanks St	NRMRA	02/09/1990	0	1

Worcester

Town/Name/Address	Designation	Date	# Props
Worcester (cont.)			2
Armsby Building	NRIND	03/05/198	0 1
Armsby Building 144-148 Main St		03/05/198	
Ash Street Schoolhouse		03/05/198	
Ash St	NRMRA (03/05/198	0 1
The state of Town Market Market Contour	METMO	03/05/198	0 1
Ashworth and Jones Woolen Textile Factory 1511 Main St		03/05/198	
ISII Main St		,,	S 5
Babcock Block	NRIND (03/05/198	0 1
600 Main St	NRMRA (03/05/198	0 1
		00/00/200	
Baker, Peter Three-Decker		02/09/199 02/09/199	
90 Vernon St	INDIAN	02/03/133	
Bancroft Building	NRMRA	03/15/200	2 2
60 Franklin St	NRIND	03/15/200	2 2
		07/01/200	2 2
	Exp:		
Bancroft Hotel, The	MRIMD	03/05/198	0 1
50 Franklin St		03/05/198	
JV LEGINGEN DO			
Bancroft Tower		03/05/198	
Bancroft Tower Rd	NRIND	03/05/198	0 1
- market	METNE	03/05/198	0 1
Bannister, Emory House 3 Harvard St		03/05/198	
3 harvard Sc	· Munus	00,00,100	-
Barker, Richard Octagon House	NRIND	03/05/198	0 1
312 Plantation St	NRMRA	03/05/198	0 1
	ND 711D	00/00/100	0 0
Battelle, Marion Three-Decker 13 Preston St		02/09/199 02/09/199	
13 Preston St	Munds		-
Beacon Street Firehouse	NRIND	03/05/198	0 1
108 Beacon St	NRMRA	03/05/198	0 1
Beaver Street Historic District		02/09/199 02/09/199	
31-39 Beaver St	MANA	02/03/133	,
Bentley, George - Jackson, Daniel H. Cottage	NRIND	03/05/198	0 1
9 Earle St	NRMRA	03/05/198	0 1
		/ /	
Blackstone Canal Historic District	NRDIS	08/15/199	5 89
(Blackstone / Grafton / Millbury / Millville / Northbridge / Sutton / Uxbridge / Worcester)			
Motomptiage / Sactou / Ovpriage / Motoester/			
Bliss, William H. Building		03/05/198	
26 Old Lincoln St	NRMRA (03/05/198	0 1

	Town/Name/Address	Designation	Date	# Props
	Co. Strain			
Wo	rcester (cont.)	×		
	Blodgett, Lydia Three-Decker	NRIND	02/09/199	0 1
	167 Eastern Ave	NRMRA	02/09/199	0 1
	and the second s	200 00000		
	Bloomingdale Fire House		03/05/198	
	267 Plantation St	NRMRA	03/05/198	30 1
	Bloomingdale Grammar School	NRIND	03/05/198	30 1
	327 Plantation St	NRMRA	03/05/198	30 1
	The second of th	200359-100		TO 15
	Borden, John - Pond, Lucius W. House		03/05/198	
	40 Laurel St	NRMRA	03/05/198	30 1
	Bostrom, Eric Three-Decker	NRIND	02/09/199	0 1
	152 Eastern Ave	NRMRA	02/09/199	0 1
	The Authorities and Authoritie			
6	Boulevard Diner		11/22/200	
	Diners of Massachuestts Multiple Property	NRMPS	11/22/200	0 1
	Submission, 155 Shrewsbury St			
	Bousquet, Henry Three-Decker	NRIND	02/09/199	0 1
	8-10 Fairmont Ave	NRMRA	02/09/199	0 1 .
	and the second s	10 - 43	0.00	
	Boynton, The and Windsor, The		03/05/198	
	718 and 720 Main St	NRMRA	03/05/198	10 2
	Brightside Apartments	NRIND	03/05/198	0 1
	2 King St	NRMRA	03/05/198	0 1
	\$1. 56-9 000 4000 00 00 00 00 00 00	4/9/4/1944/The 41/1		520 125
	Brooks, John H. House		03/05/198	
	12 Nelson Pl	NRMRA	03/05/198	0 - 1
	Cambridge Street Firehouse	NRIND	03/05/198	0 1
	526-534 Cambridge St	NRMRA	03/05/198	0 1
	Cambridge Street School		03/05/198	
	510 Cambridge St	NRMRA	03/05/198	0 1
	Carlson, Eric Three-Decker	NRIND	02/09/199	0 1
	154 Eastern Ave	NRMRA	02/09/199	0 1
	Castle Street Row	NRDIS	02/16/200	1 1
	(Boundary Increase) 20-24 Castle St			*
	Castle Street Row	NRDIS	03/05/198	0 8
	4-18 Castle St		03/05/198	
2.5				10
	Cathedral of Saint Paul		03/05/198	
	15 Chatham St	NRMRA	03/05/198	0 1

	•5:			
Town/Name/Address	Designation		Props	
Wordester (cont.)	#			
Chadwick - Brittan House	NRIND	03/05/1980	1	
309 Lincoln St	NRMRA (03/05/1980	1	
Chadwick Square Diner	NRDIS	03/05/1980	1	
Diners of Massachusetts Multiple Property		11/26/2003		
Submission, 95R Prescott St		11/26/2003		
Chamberlain, Charles W. House	NRIND	03/05/1980	1	
373 Pleasant St	NRMRA (03/05/1980	1	
Chamberlain, William - Flagg, Elisha House	NRIND (03/05/1980	1	
2 Brookshire Rd	NRMRA (03/05/1980	1	×
Clark University Historic District	NRDIS	03/05/1980	5	
950 Main St	0.0000000000000000000000000000000000000	03/05/1980		
950 Main Sc	NRPIGS (03/03/1900	, ,	
Cobb, George R. House	NRIND (03/05/1980	1	
24 William St	NRMRA (03/05/1980	1	
Colton's Block	NRIND (03/05/1980	1	
586-596 Main St	NRMRA (03/05/1980	1	
Copeland, Samuel Carriage House	NRIND (03/05/1980	1	
31 Harvard St		03/05/1980		
31 haivata 50		10/23/1998		
-	Exp:			
Copeland, Samuel House	NRIND (03/05/1980	1	
31 Harvard St		03/05/1980		
Corner Lunch Diner	מואד פוא	11/15/2000	1	
\(\tau_{i}(11/15/2000		
Diners of Massachusetts Multiple Property Submission, 133 Lamartine St	NRMPS .	11/15/2000	•	
Crabtree, Thomas Three-Decker	NRIND (02/09/1990	2	
22 Haynes St	NRMRA (02/09/1990	2	
Crawford, Elias B. Octagonal House	NRIND (03/05/1980	1	
3 Norwood St	NRMRA (03/05/1980	1	
Crompton Loom Works	NRIND (03/05/1980	1	
132-142 Green St		3/05/1980		
132-142 Gieen Sc		08/15/1995		
Crown Street, 4	PR (02/27/1975	1	
4 Crown St		00/01/1075	1	
		08/01/1975		
	NKDIS	5/06/1976	. T	

					29
Town/Name/Address		0	Designation	n Date	# Props
5 ^					
Worcester (cont.)					
Crown Street, 5			NRDOE	08/01/19	75 1
5 Crown St	54			04/26/19	76 1
			Exp:	05/06/197	76 1
			NRDIS	03/00/13	, o T
Crown Street, 6				08/01/197	
6 Crown St				05/06/197	
			PR	05/26/198	33 1
			Exp:		
Crystal Street Historic District	92		NRDIS	02/09/199	0 5
30-34 Crystal St			NRMRA	02/09/199	90 5
Daniels, Frederick H. House		15	NRIND	03/05/198	30 1
148 Lincoln St			NRMRA	03/05/198	30 1
Daniels, Walter House			NRDOE	08/01/197	75 1
2 Congress St				05/06/197	
H 562				10/04/197	77 1
<i>₩</i>			Exp:	55	
Dartmouth Street Schoolhouse	- E		NRIND	03/05/198	30 1
13 Dartmouth St			NRMRA	03/05/198	30 1
Davis, Isaac House			NRIND	03/05/198	30 1
59 Elm St			NRMRA	03/05/198	10 1
Davis, Joseph Estabrook House			NRIND	03/05/198	80 1
41 Elm St			NRMRA	03/05/198	0 1
Davis, Rodney Three-Decker			NRIND	02/09/199	0 1
62 Catharine St				02/09/199	
David - Markey Mhuse Doglery			NDTND	02/09/199	0 2
Davis, Wesley Three-Decker 7 Albert St				02/09/199	
, Albert St			*********	00,00,00	-
Day Building				09/13/197	
300-310 Main St				03/05/198	
			NRDIS	03/05/198	0 1
Dayton, Horace House	132		NRDOE	08/01/197	5 1
12 Crown St				05/06/197	
				10/14/197	6 1
Dan Book I and Makel II Wasser			PR .	11/21/199	7 1
Dean, Frank L. and Mabel H. House 10 Cedar St			Exp:	11/61/199	, 1
				12/05/200	2 1

Town/Name/Address Des:	anation	Date	# Prope
			т ггора
		86	
Worcester (cont.)			87
CONTRACTOR			
Dean, Mary Three-Decker	NRIND	02/09/199	0 1
130 Belmont St	NRMRA	02/09/199	0 1
Delsignore, Louis Three-Decker		02/09/199	
12 Imperial Rd	NRMRA	02/09/199	0 2
Dewey, Francis H. House	NRIND	03/05/198	0 1
71 Elm St		03/05/198	
71 11111 100	and not	05, 05, 150	· -
Diners of Massachusetts	NRMPS	09/22/199	9 5
Multiple Property Submission			
■ 11 System Colors ■ The tries is prote ■ Machine Colors Colors Colors Street Colors Colors Street Colors			
Dodge, Helen Three-Decker	NRIND	02/09/199	0 1
570 Pleasant St	NRMRA	02/09/199	0 1
			e 683
Doran, Thomas F. Three-Decker		02/09/199	
27 John St	NRMRA	02/09/199	0 1
	110 T110	02/05/200	
Dowley, Levi A Taylor House		03/05/198	
770 Main St		12/04/199	
	Exp:	12/04/199	0 1
ta	DAP.		
Downing Street School	NRIND	03/05/198	0 1
92 Downing St		03/05/198	
Drew, Elvira Three-Decker	NRIND	02/09/199	0 1
42 Abbott St	NRMRA	02/09/199	0 1
		- 19	
Duke, Philip Three-Decker		02/09/199	
7 Maxwell St	NRMRA	02/09/199	0 3
D	ATD TATO	02/09/199	2
Dworman, David Three-Decker 159 Providence St		02/09/199	
159 Plovidence St	MAPIKA	02/03/133	, ,
East Worcester Grammar School	NRIND	03/05/1980	0 1
10 East Worcester St		03/05/1980	
		34 34	
Elizabeth Street Schoolhouse	NRIND	03/05/1980	1
31 Elizabeth St	NRMRA	03/05/1980	1
	<u>C</u>		
Elm Park		07/01/1970	
Bounded by Elm, Russell, Highland and Pleasant		03/05/1980	3.
Sts on the west and north by Federal and Norton Pl	53.00	±5.	
m- original wishests mistrales	MDDTO	02/00/2004	. 15
Elm Street Historic District	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	02/09/1990	
132-148 Elm St	NAMAN	02/09/1990	1/
English High School Building	MRTMD	03/05/1980) 1
20 Irving St		03/05/1980	
20 IIVING SC	MUM	03/03/1300	

Town/Name/Address	Designation	n Date	Props
Wormander (cont.)			19
Worcester (cont.)			
Enterprise Building	NRIND	03/05/1980	1
538-540 Main St	NRMRA	03/05/1980	
SOURCE AND DOLD WOOD DEPOS AND THE AREA OF A			
Erickson, Knut Three-Decker		02/09/1990	
19 Stanton St	NRMRA	02/09/1990) 1
Euclid Avenue - Montrose Street Historic District	NRDIS	02/09/1990	54
Along Euclid Ave and Montrose St, between Vernor		02/09/1990	
St and Perry Ave		35 53 6	
n 1/ 1 W 1 m 1	MDTMD	03/05/1980) 1
Evangelical Mission Chapel		03/05/1980	
205 Summer St	DD	02/09/1998	3 1
	Exp:	02/09/1996	, 1
Fairlawn Estate		03/05/1980	
189 May St	NRMRA	03/05/1980	1
Bar Sharet Wigheria District	MENTS	02/09/1990	3
Fay Street Historic District 4-6 Fay St		02/09/1990	
4-6 ray St	MANA	02/05/1550	, ,
Fitch, Charles H. House		03/05/1980	
15 Oread St	NRMRA	03/05/1980	1
THE COURT OF THE C	NDTND	03/05/1980	1
Flagg, Amos House 246 Burncoat St		03/05/1980	
246 Burncoat St	Michica	03/03/1300	
Flagg, Benjamin II House	NRIND	03/05/1980	1
136 Plantation St	NRMRA	03/05/1980	1
			(5) (4)
Flagg, Levi Three-Decker		02/09/1990	
79 Florence St	NRMRA	02/09/1990	0 1
Fontaine, George Three-Decker	NRIND	02/09/1990	1
141 Vernon St		02/09/1990	
Forbes, William Trowbridge House	NRIND	03/05/1980	1
23 Trowbridge Rd	NRMRA	03/05/1980	1
2777 2 2			
Forest Hill Cottage		03/05/1980	
22 Windsor St	NRMRA	03/05/1980) 1
Freeland Street Schoolhouse	NRIND	03/05/1980	1
12 Freeland St	NRMRA	03/05/1980	1
Salvers Control Contro		00/02/2020	
French, Jonathan C. House	 International Control 	08/01/1975	
9 Crown St		05/06/1976	
7	PR	00/11/13/6	
Fig. 45	Exp:		

Town/Name/Address	Designation Date # Pro	ps
Worcester (cont.)		
Friberg, Andrew Three-Decker	NRIND 02/09/1990 1	
26 Ames St	NRMRA 02/09/1990 1	
Friends' Meetinghouse	PR 02/25/1972 1	
Oxford and Chatham St	Exp:	
	NRDOE 08/01/1975 1	
0	NRDIS 05/06/1976 1	
and the second s		
G. A. R. Hall	NRIND 03/13/1975 1	
55 Pearl St	PR 07/20/2005 1	
	Exp:	
Gabriel, George W. House	NRIND 03/05/1980 1	
31 Lenox St	NRMRA 03/05/1980 1	
Gale, George House	NRIND 03/05/1980 1	0
15 Elizabeth St	NRMRA 03/05/1980 1	
is biliabeth bt		
Giguere, Thomas Three-Decker	NRIND 02/09/1990 2	
18 Fairhaven Rd	NRMRA 02/09/1990 2	
Gilman Block	NRIND 11/20/2000 1	
207-219 Main St (Demolished 2002		
Goddard, Harry Williams House	NRIND 03/05/1980 1	
190 Salisbury St	NRMRA 03/05/1980 1	
	LHD 04/27/1993 1	
Goddard, Henry House	NRIND 03/05/1980 1	
12 Catharine St	NRMRA 03/05/1980 1	
Goldberg Building	NRIND 11/19/2007 1	
97-103 Water St	NRMRA 11/19/2007 1	
, 57 100 macor 50	0	
Goss, Samuel A. House	NRDOE 08/01/1975 1	
11 Oxford St	NRDIS 05/06/1976 1	
¥1	PR 01/31/1978 1	
ă	Exp:	
Goulding, Henry Mansion	NRIND 03/05/1980 1	
26 Harvard St	NRMRA 03/05/1980 1	
Goulding, W. H. House	NRIND 03/05/1980 1	
4 Dix St	NRMRA 03/05/1980 1	
Grafton Street Schoolhouse #1	NRIND 03/05/1980 1	
303 Grafton St	NRMRA 03/05/1980 1	2
JUJ GLULDON DE		
Grafton Street Schoolhouse #2	NRIND 03/05/1980 1	
293 Grafton St	NRMRA 03/05/1980 1	

Town/Name/Address	Desi	gnation	Date	#	Props
				-	
Worcester (cont.)		11237			
Green Hill Park Shelter		METMO	03/05/19	00	1
Green Hill Pkwy			03/05/19		
Green HIII PAWY			04/21/19		1
₩ #3	8	Exp:	04/21/15	03	
Greendale Branch Public Library		NRIND	03/05/19	80	1
470 West Boylston St			03/05/19		
Greendale Village Improvement Society Building 480 West Boylston St		NRIND	11/07/19	76	1 .
Gullberg, Evert Three-Decker		NRIND	02/09/19	90	1
18 Ashton St			02/09/19		
Hadley, Gilbert Three-Decker		NRIND	02/09/19	90	1
31 Russell St			02/09/19		
Hall, Charles A. Three-Decker		NRTND	02/09/199	90	1
68 Mason St			02/09/19		
Hammond Heights Historic District		NRDIS	03/05/198	30	80
Germain, Haviland, Highland and Westland Sts an	nd		03/05/198		
Institute Rd	9	+ 1			
Hammond, Andrew H. Organ Reed Factory			03/05/198		1
9 May St		NRMRA	03/05/198	30	1
Harding - Winter Street Manufacturing District		NRDIS	03/05/198	30	8
Water and Winter Sts		NRMRA	03/05/198	30	8
Harris, Clarendon - Merrick, Pliny House		NRIND (03/05/198	30	1
41 Fruit St		NRMRA	03/05/198	30	1
Hastings, John E. Cottage		NRIND (03/05/198	30	1
31 William St	6)	NRMRA (03/05/198	30	1
Higgins, Aldus House		NRIND (03/05/198	30	4
1 John Wing Rd			03/05/198		4
Higgins, John Woodman Armory Museum		NRIND (03/05/198	30	1
100 Barber Ave			03/05/198		1
			05/18/198		1
× ×		Exp:			
Hirst, Samuel Three-Decker		NRIND (02/09/199	0	2
90 Lovell St			02/09/199		2
Hobbs, Marcus House	9.7	NRIND (03/05/198	0	1
16 William St			3/05/198		1

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	Town/Name/Address ·	Designation		Props
			-	
Wo	rcester (cont.)		10	
	Hogg, William James House		03/05/1980	
	54 Elm St	NRMRA	03/05/1980	1
	Holy Cross College - Fenwick and O'Kane Halls		03/05/1980	
	Holy Cross College Campus	NRMRA	03/05/1980	8
	Holy Name of Jesus Complex		06/09/1988	
	Illinois St	NRMRA	06/09/1988	5
	Hope Cemetery	NRIND	12/22/1997	40
	119 Webster St			
	Hope Cemetery - Norcross, James A. Mausoleum		12/22/1997	
	119 Webster St	PR Exp:	10/07/2002	1
	W.	n s		
	Hotel Aurora, The	NRIND	04/28/1988	1
	652-660 Main St	NRMRA	04/28/1988	1
	Houghton Street Historic District	NRDIS	02/09/1990	10
	49-65 Houghton St, 147 Dorchester St	. NRMRA	02/09/1990	10
	Hunt, Daniel E. Three-Decker	NRIND	02/09/1990	1
	9 Wyman St	NRMRA	02/09/1990	1
	Hunt, David Three-Decker		02/09/1990	
	26 Louise St	NRMRA	02/09/1990	1
	Indian Hill - North Village District		03/05/1980	
	Ararat St and Delaval, Heroult, Watt, Marconi Westinghouse Rds	and NRMRA	03/05/1980	95
	Ingleside Avenue Historic District	NRDIS	02/09/1990	7
	218-228 Ingleside Ave	NRMRA	02/09/1990	7
	Ingraham, Harry B. Three-Decker		02/09/1990	
	19 Freeland St	NRMRA	02/09/1990	1
	Institutional District	NRDIS	03/05/1980	11
	Lincoln and Wheaton Sqs, Salisbury and Tuckerm Sts	an NRMRA	03/05/1980	11
	International Order of Odd Fellows Building	NRMRA	03/05/1980	1
	674 Main St	NRIND	03/05/1980	1
	Johnson, Edwin Three-Decker	NRIND	02/09/1990	1
	183 Austin St	NRMRA	02/09/1990	1
	Johnson, John and Edward Three-Decker		02/09/1990	
	31 Louise St	NRMRA	02/09/1990	1

Town/Name/Address	Designation Date #	Props
Worcester (cont.)	30	
Johnson, John Three-Decker	NRIND 02/09/1990	1
140 Eastern Ave	NRMRA 02/09/1990	
Johnson, Paul Three-Decker	NDTND 02/00/1000	
7 Stanton St	NRIND 02/09/1990 NRMRA 02/09/1990	
Junction Shop and Hermon Streets	NRDIS 03/05/1980	23
Beacon, Hermon and Jackson Sts	NRMRA 03/05/1980	
Kaller, Erick Three-Decker	NRIND 02/09/1990	1
146 Eastern Ave	NRMRA 02/09/1990	
Kaller, Erick Three-Decker	NRIND 02/09/1990	1
148 Eastern Ave	NRMRA 02/09/1990	
Katz and Leavitt Apartment House	NRIND 03/05/1980	1
53 Elm St	NRMRA 03/05/1980	
Knollwood District	NRDIS 03/05/1980	8
425 Salisbury St	NRMRA 03/05/1980	8
Knowles, Lucius J. House	NRIND 03/05/1980	1
838 Main St	NRMRA 03/05/1980	ı
Larchmont	NRIND 03/05/1980	1
36 Butler St	NRMRA 03/05/1980	1
Larson, Swan Three-Decker	NRIND 02/09/1990	1
12 Summerhill Ave	NRMRA 02/09/1990	
Legg, John House	NRIND 03/05/1980	1
5 Claremont St	NRMRA 03/05/1980	10.00
Levenson, Morris Three-Decker	NRIND 02/09/1990	1
38 Plantation St	NRMRA 02/09/1990	
Liberty Farm	NRIND 09/13/1974	1
116 Mower St	NHL 09/13/1974	
Lincoln Estate - Elm Park Historic District	NRDIS 03/05/1980	62
Cedar, Fruit, Oak, West and William Sts	NRMRA 03/05/1980	
Lincoln, Gov. Levi House	NRIND 03/05/1980	1
4 Avalon Pl	NRMRA 03/05/1980	
Lower Pleasant Street District	NRDIS 03/05/1980	6
9-49 Pleasant St, 418-426 Main St	NRMRA 03/05/1980	6
Lumb, Thomas Three-Decker	NRIND 02/09/1990	1
80 Dewey St	NRMRA 02/09/1990	

Town/Name/Address	Designation	Date	# Props
Worcester (cont.)			
Lumb, Thomas Three-Decker	MD TND (2/09/199	0 1
44 Winfield St		02/09/199	
44 Willield St	MANA	12/03/133	0 1
Lundberg, Charles Three-Decker	NRIND (2/09/199	0 1
67 Catharine St	NRMRA (2/09/199	0 1
Magnuson, Charles Three-Decker	NRIND (2/09/199	0 1
56-58 Olga Ave		2/09/199	
Main Church Doubish Church	ND TND (3/05/198	0 7
Main Street Baptist Church 717 Main St		3/05/198	
/1/ Main St		4/01/199	
	Exp:	4/01/100	· •
	D.p.		25
Malvern Road School	NRIND 1	0/04/198	4 1
Malvern Rd	NRMRA 1	.0/04/198	4 1
	ND TAID (3/05/198	0 1
Marble, Jerome House 23 Harvard St		3/05/198	
23 Harvard St	NRMRA C	3/03/196	0 1
Mark, John H. Three-Decker	NRIND 0	2/09/199	0 1
24 Sigel St	NRMRA 0	2/09/199	0 1
Marsh, Alexander House	NRIND 0	3/05/198	0 1
57 Elm St		3/05/198	
Masonic Temple		3/05/198	
Ionic St	NRMRA 0	3/05/198	0 1
Massachusetts Avenue Historic District	NRDIS 1	2/16/197	1 11
Between Salisbury and Drury Ln		10 1	
Massachusetts Avenue Historic District	LHD 0	9/02/197	5 20
Massachusetts Ave and Regent St between Salisb			
St and Drury Ave.			
Massad, Anthony Three-Decker	NID TNID O	2/09/199	0 1
14 Harlow St		2/09/199	
14 Hallow De		-,,	-
May Street District	NRDIS 0	3/05/198	0 27
May St	NRMRA 0	3/05/198	0 27
was seen and an	ND TND O	2/00/100	0 1
McCafferty, Elizabeth Three-Decker		2/09/199	
45 Canterbury St	NRMRA U	2/09/199	0 1
McCarron, Andrew Three-Decker	NRIND 0	2/09/199	0 1
3 Pitt St	NRMRA 0	2/09/1990	0 1
		2/02/200	
McDermott, John B. Three-Decker		2/09/1990	
21 Freeland St	NRMRA 0	2/09/1990	0 2

Town/Name/Address	Designation	Date #	Props
·			
Worcester (cont.)	ST		
McFarland, William House	NRIND	03/05/1980	1
525 Salisbury St	NRMRA	03/05/1980	1
		00/00/1000	
McGrath, Patrick Three-Decker 50 Dorchester St		02/09/1990 02/09/1990	
50 Dorchester St	MANA	02/03/1330	_
McGuinness, Patrick Three-Decker		02/09/1990	
25 Suffield St	NRMRA	02/09/1990	1
		00/00/1000	4
McPartland, Frank Three-Decker		02/09/1990 02/09/1990	
61 Paine St	NRMRA	02/09/1990	-
McPartland, James Three-Decker	NRIND	02/09/1990	1
17 Pond St	NRMRA	02/09/1990	1
	NRDIS	08/15/1995	1
ALL AND A PROPERTY AND AND A PARTY.	NETNE	11/09/1972	1
Mechanics Hall		03/05/1980	
321 Main St		03/05/1980	
Y 25			
Mechanics Hall District	NRDIS	03/05/1980	8
Main St	NRMRA	03/05/1980	8
CONTRACTOR AND SECTION	0.t		
Merrill Double House		03/05/1980	
18-20 West St	NRMRA	03/05/1980	1
Miles, Charles House	NRIND	03/05/1980	1
131 Lincoln St	NRMRA	03/05/1980	1.
			N 128
Milestone, 1767	NRIND	04/07/1971	1
39 Salisbury Street (Moved to 30 Elm Street)		38	
Milestone, 1767	NRIND	04/07/1971	1
Lincoln St			
Millbury Street Schoolhouse #4		03/05/1980	
24 South Ward St	NRMRA	03/05/1980	1
	NRTND	11/21/2003	2
Miss Worcester Diner Diners of Massachusetts Multiple Property		11/21/2003	
Submission, 302 Southbridge St	50		
Monroe, Sarah Three-Decker	. NRIND	02/09/1990	1
11 Rodney St	NRMRA	02/09/1990	1
	* N		
Montvale Historic District		04/27/1993	51
Salisbury St and Montvale, Whitman, Monadnock as	nd		
Waconah Rds			

20			
Town/Name/Address	Designation	Date	# Props
Worcester (cont.)			
Montvale Historic District	NRDIS	03/05/1980	19
Monadnock, Sagamore, Waconah and Whitman Rds and	NRMRA	03/05/1980	19
Salisbury St			1000
Moore, Jesse House	NRIND	03/05/1980	1
25 Catharine St	NRMRA	03/05/1980	1
. X.		927	
Murphy, Patrick Three-Decker	NRIND	02/09/1990) 1
31 Jefferson St	NRMRA	02/09/1990	1
Nelson, Christina Three-Decker	NRIND	02/09/1990	1
45 Butler St	NRMRA	02/09/1990	1
Newton, Charles House		03/05/1980	
24 Brattle St	NRMRA	03/05/1980	1
*			
Newton, S. D. House		03/05/1980	
8 Sycamore St	NRMRA	03/05/1980	1
	50,000,000		
Norcross Brothers Houses		03/05/1980	
16 and 18 Claremont St	NRMRA	03/05/1980	2
ALL PROPERTY SERVICES AND			
North Worcester Aid Society Building		03/05/1980	
58. Holden St	NRMRA	03/05/1980	1
O'Brien, Richard Three-Decker	NRTND	02/09/1990	1
43 Suffolk St		02/09/1990	
45 SULICIA SC	21101101		
O'Connor, James - John Trybowski Three-Decker	NRIND	02/09/1990	1
21 Canton St		02/09/1990	
21 cancon be			
O'Connor, James Three-Decker	NRIND	02/09/1990	1
23 Endicott St	NRMRA	02/09/1990	1
			0.00
Oxford - Crown Extension District		07/20/1979	
Ashland, Congress, Chatham, Crown and Pleasant	NRMRA	03/05/1980	33
Sts	NRDIS	03/05/1980	33
Oxford - Crown Historic District		08/01/1975	
Bounded by Chatham, Congress, Pleasant and Oxfor	d NRDIS	05/06/1976	30
Sts and Oxford Pl			(1)
	55		
Paine, Timothy House	NRIND	04/30/1976	5 1
140 Lincoln St			
27.4.27444	MD TMD	03/05/1980	. 1
Park Building		03/05/1980	
507 Main St	NKMKA	03/03/1380	
Bower Aronno Historia District	NEDIC	02/09/1990	5
Perry Avenue Historic District 49-55 Perry St		02/09/1990	
49-33 Perry Sc	2422222	,,	7

		9.7		
	Town/Name/Address	Designation	Date	# Props
Wo	rcester (cont.)	<u></u>		
	Petterson, Lars - Carlson, Adolph Three-Decker	NRIND (02/09/199	2
	76 Fairhaven Rd		02/09/199	
į		11D T11D	00/00/100	
	Petterson, Lars - Gurney, Fred Three-Decker 2 Harlow St		02/09/1990 02/09/1990	
*	z nariow st	Midney (22,00,100	-
	Petterson, Lars - Reidy, James Three-Decker		02/09/1990	
	4 Harlow St	NRMRA (02/09/1990	1
	Petterson, Lars - Silas Archer Three-Decker	NRIND (02/09/1990) 1
	80 Fairhaven Rd		02/09/1990	
÷				2.72
	Pilgrim Congregational Church		03/05/1980 03/05/1980	
	909 Main St	NRMRA (3705/1980	, 1
	Pleasant Street Firehouse	NRMRA (03/05/1980	1
	408 Pleasant St	NRIND (03/05/1980	1
	Prentiss, Addison - Hanson, Charles F. House	NRTND (03/05/1980	1 -
	3 Channing Way		3/05/1980	
	5 5 5 19 25 8 19 19		/ /	
	Providence Street Fire House		03/05/1980 03/05/1980	
	98 Providence St	NRMRA (13/05/1980	, 1
	Providence Street Historic District		02/09/1990	
	127-145 Providence St	NRMRA (02/09/1990	17
	Provost, Arthur Three-Decker	NRIND (2/09/1990) 1
	30 Thorne St		2/09/1990	
		000000000000000000000000000000000000000		
	Putnam, Otis E. House)3/05/1980)3/05/1980	
	25 Harvard St	NRMA (73/03/1900	, 1
	Quinsigamond Branch Library	NRIND (3/05/1980	1
	8 Blackstone River Rd	NRMRA (3/05/1980	1
	Quinsigamond Firehouse	NRIND (3/05/1980) 1
	15 Blackstone River Rd		3/05/1980	
		AND TAND	3/05/1980	1
	Raymond, Tilley House 12 George St		3/05/1980	
	12 George St		1/21/2002	
		Exp:	,,	V 2552
	Read Event Mhyon Deriver	METME	2/09/1990) 1
	Reed, Frank Three-Decker 913-915 Main St		2/09/1990	
	313-313 Main 90	THE STATE OF THE S	-,05,2550	v 5.54
	Rice, Ezra Beaman House		3/05/1980	
	1133 West Boylston St	NRMRA 0	3/05/1980	1

Town/Name/Address	Designation	Date #	Props
Worcester (cont.)	*	25	
Richmond, Willard Apartment Block	NETND .	11/07/1985	1
43 Austin St	2.0	11/07/1985	
Didward Bloom Mhusa Dankon	ND TND (02/09/1990	1
Ridyard, Albert Three-Decker 5 Mount Pleasant St		02/09/1990	200
	· ND TND	02/09/1990	1
Ridyard, B. E. Three-Decker 29 Dewey St		02/09/1990	1
Riordan, John Three-Decker	· NRTND	02/09/1990	1
8 Dix St		2/09/1990	
Robinson and Swan Blocks	NRIND (3/05/1980	2
104-108 Pleasant St and 1-3 Irving St	1 T O STOLEN OF THE STOLEN	03/05/1980	
Rogers - Kennedy Memorial Monument	NRIND (07/01/1970	1
Elm Park		03/05/1980	
BIM FAIR		10/24/1987	
	Exp:	THE \$ 1000 HOUSE STATE OF THE S	
Ronayne, Catherine Three-Decker	NRIND	02/09/1990	1
18 Ingalls St	NRMRA	02/09/1990	1
Ruggles, Draper House	NRIND	03/05/1980	. 1
21 Catharine St	NRMRA	03/05/1980	1
Russell, The	NRMRA :	11/07/1985	1
49 Austin St	NRIND :	11/07/1985	1
Saint John's Roman Catholic Church	NRIND	03/05/1980	1
40 Temple St	NRMRA	03/05/1980	1
Saint Mark's Episcopal Church	NRIND	03/05/1980	1
6 Freeland St		03/05/1980	1
Saint Matthew's Episcopal Church	NRIND	03/05/1980	1
693 Southbridge St	NRMRA (03/05/1980	1
Saint Peter's Roman Catholic Church	NRIND	03/05/1980	1
935 Main St		03/05/1980	1
Salisbury Factory Building	NRIND	03/05/1980	1
25 Union St	NRMRA	03/05/1980	1
Salisbury Factory Building	NRIND	03/05/1980	1
49-51 Union St		03/05/1980	1
Salisbury House	NRIND	06/25/1975	1
61 Harvard St			

Town/Name/Address	Designation	n Date	# Props
Worcester (cont.)			
Salisbury Mansion	,mp.ra	05/00/105	
40 Highland St		05/30/197	
40 Hightana St	PR Exp:	12/24/198	5, 1
Salisbury Mansion and Store	MDTG	05/20/205	
30 and 40 Highland St	NRDIS	05/30/197	5 2
Sawyer, Ezra House	NRDOE	08/01/197	5 1
7 Crown St		05/06/197	
25 - 3 F1002004 AT VICTORS		06/19/198	
	Exp:		5 G
	PR	02/23/199	9 1
	Exp:	02,20,200	
g an 197	mario.		
Schofield, James House	NRTND	03/05/198	0 1
3 Mount Pleasant St		03/05/198	
380			8 8
Sharaai Torah Synagogue	NRIND	05/07/199	0 1
32 Providence St		05/07/199	
Shattuck, Moody Edson House	NETNE	03/05/198	0 1
768 Main St		03/05/198	
	Mulion	03/03/190	v ±
Shea, Bridget Three-Decker	NRIND	02/09/199	0 1
21 Jefferson St		02/09/199	
Shepard, Dea. Constant House	NRDOE	08/01/197	5 1
14 Crown St	NRDIS	05/06/197	5 1
84 38	PR	06/14/197	5 1
	Exp:		
Simpson, Clara Three-Decker	NRIND	02/09/199) 1
69 Piedmont St		02/09/1990	
Ambounds with the modern and the state of th			
Slater Building	NRIND	03/05/1980	1
390 Main St	NRMRA	03/05/1980	1
92019950 522 62 563 \$522 \$200 \$60			
Smith - Thaxter - Merrifield House		03/05/1980	
158 Holden St	NRMRA	03/05/1980) 1
Smith, Ellen M. Three-Decker	NRIND	02/09/1990	1
22 Kilby St		02/09/1990	
50.70.2021.54 1976.	0.544577457454		81 1970s
Smith, Elliot T. House	NRIND	03/05/1980	1
839 Main St	NRMRA	03/05/1980	1
Soho Cottage	METMO	03/05/1980	1
21 Windsor St		03/05/1980	
ar namada de	ANIMA	03/03/1980	1

Town/Name/Address	Designation		Props
Worcester (cont.)	8		
Worcester (cont.)			*
South Unitarian Church		03/05/1980	
886 Main St	NRMRA	03/05/1980	1
South Worcester Branch Library	NRIND	03/05/1980	1
705 Southbridge St	NRMRA	03/05/1980	1
Southbridge - Sargent Manufacturing District	NRDIS	03/05/1980	3
Sargent, Gold and Southbridge Sts	NRMRA	03/05/1980	3
Stark, Edward H. House	NRIND	03/05/1980	1
21 Oread St	NRMRA	03/05/1980	1
Shaha Mahaal Dailding Old	NETNE	03/05/1980	1
State Mutual Building, Old 240 Main St		03/05/1980	
240 Main Sc	111111111	00,00,000	_
Stearns Tavern	NRIND	03/05/1980	1
651 Park Ave	NRMRA	03/05/1980	1
Stevens Building	NRIND	03/05/1980	1
24-44 Southbridge St		03/05/1980	
21 11 0000.022490 00	500 12		
Stevens, Daniel House		03/05/1980	
7 Sycamore St	NRMRA	03/05/1980	1
Stoliker, Edna Three-Decker	NRIND	02/09/1990	2
41 Plantation St	NRMRA	02/09/1990	2
Stone, Edward L. Three-Decker	NRIND	02/09/1990	1
8 Wyman St		02/09/1990	
*			
Sturtevant, Leonard House		03/05/1980	
84 Mulberry St	NRMRA	03/05/1980	1
Swift, D. Wheeler House	NRIND	03/05/1980	1
22 Oak Ave	NRMRA	03/05/1980	1
Marilan Tanas C. House	NRDOE	08/01/1975	1
Taylor, Isaac C. House 3 Crown St		05/06/1976	
3 Clown Sc		06/11/1976	
	Exp:		
Tower, Horatio House	NRIND	03/05/1980	1
71 Pleasant St	NRMRA	03/05/1980	1
Troupes, John Three-Decker		02/09/1990	
25 Canton St	NRMRA	02/09/1990	1
Union Congregational Church		03/05/1980	
5 Chestnut St	NRMRA	03/05/1980	1

			100
Town/Name/Address	Designation	Date	# Props
7 Table 1 Tabl			
Worcester (cont.)		体	
Union Station	NRIND	03/05/198	0 1
Washington Sq		03/05/198	
		08/15/199	
*		09/30/199	
€ 6	Exp:	19 13	
Upsala Street School	NRIND	03/05/198	0 1
36 Upsala St	NRMRA	03/05/198	0 1
Vendome, The and Saint Ives, The	NRDIS	02/09/199	0 2
17-19, 21-23 Chandler St		02/09/199	
View Street Historic District	NRDIS	02/09/199	0 17
7-17 View St		02/09/199	
7-17 View Sc	William	02/05/155	0 1/
Waldo Street Police Station and District Court	NRIND	03/05/198	0 1
Waldo St	NRMRA	03/05/198	0 1
Washburn and Moen North Works	NRDIS	03/05/198	0 13
Grove St		03/05/198	
Webster Street Firehouse	NR TND	03/05/198	0 1
40 Webster St		03/05/198	
40 Webstel St	Withita	03/03/130	0 1
Wellington Street Apartment House District	NRDIS	03/05/198	0 16
Wellington St, Jacques Ave and Irving St	NRMRA	03/05/198	0 16
Wescott, John F Mulcahy, Ellen Three Decker	NRIND	02/09/199	0 1
454 Pleasant St	NRMRA	02/09/199	0 1
Wesson, Franklin House	MPTMD	03/05/198	0 1
8 Claremont St		03/05/198	
8 Claremont St	NAMA	03/03/130	v -
Whitcomb, G. Henry House	NRIND	11/09/197	7 2
51 Harvard St	PR	05/03/198	2 2 .
	Exp:		
Whittall Mills	MPDTS	03/05/198	0 15
		03/05/198	
Off Brussels St	NAMICA	03/03/130	0 13
Woodford Street Historic District		02/09/199	
35-40 Woodford St	NRMRA	02/09/199	0 10
Woodland Street Firehouse	NRIND	03/05/198	0 1
36 Woodland St	NRMRA	03/05/198	0 1
Woodland Street Historic District	NRDIS	03/05/198	0 19
Bounded by Woodlawn, Hawthorne, Louden and		03/05/198	
Norwood Sts			500 0 110 00

3			
Town/Name/Address	Designation	Date #	Props
Worcester (cont.)		*	
Worcester Academy - Abercrombie House	NRDIS	03/05/1980	1
81 Providence St		03/05/1980	
32 11312danta 31	PR	04/15/2003	1
ti "	Exp:		
Worcester Academy - Megaron, The	NRDIS	03/05/1980	1
81 Providence St		03/05/1980	
	PR	09/21/1998	1
	Exp:	=	
Worcester Academy Historic District	NRDIS	03/05/1980	7
Worcester Academy Historic District Worcester Academy Campus		03/05/1980	
Wordester Academy Campus		00,00,200	
Worcester Asylum - State Hospital	NRDIS	03/05/1980	18
365 Belmont St	NRMRA	03/05/1980	18
Worcester Bleach and Dye Works 60 Fremont St	NRIND	11/08/2000	1
Wannaghan Cibu Hall	NRDIS	03/29/1978	1
Worcester City Hall 455 Main St		05/23/1990	
455 Main St	Exp:	,,	-37-4
	MDDIC	03/29/1978	
Worcester City Hall and Common 455 Main St	NRDIS	03/29/19/0	. 2
		i d an makan masa	
Worcester Consolidated Street Railway Carbarn 99-109 Main Street (Demolished 1980)	NRDOE	05/18/1979) 1
Worcester Corset Company Factory	NRIND	10/04/1984	1
30 Wyman St		10/04/1984	
3	MDTMD	03/05/1980	
Worcester County Institution for Savings		03/05/1980	
365 Main St	MANA	03/03/1300	-
Worcester Five Cents Savings Bank		09/13/1978	
316 Main St		03/05/1980	
N	NRMRA	03/05/1980) 1
Worcester Market Building	NRIND	03/05/1980	1
631 Main St	NRMRA	03/05/1980	1
Worcester Multiple Resource Area 20 districts and 140 individual properties with the incorporated city limits of Worcester		03/05/1980	505
Worcester Odd Fellow's Home	NRIND	03/05/1980	1
40 Randolph Rd		03/05/1980	
40 Kandorph Ad			

Town/Name/Address	Designation	Date	# Props
Worcester (cont.)			
Wolcestel (Cont.)			
Worcester Polytechnical Institute Historic Dist.		03/05/198	
Bounded by Boynton and West Sts and Institute Rd	NRMRA	03/05/198	0 10
Zemaitis, Anthony Three-Decker		02/09/199	
35 Dartmouth St	NRIND	02/09/199	0 1
Worthington		*	
Center Cemetery	NRIND	02/26/200	4 41
Sam Hill Rd			
Four Corners Farm		10/15/198	5 1
27 Old North Rd	Exp:		
Nouth Comptons	NRTND	03/03/200	4 35
North Cemetery Cold St	***************************************	00,00,000	
COIG DE			
Ringville Cemetery	NRIND	02/11/200	4 17
Witt Hill Rd			
South Worthington Historic District (Worthington/Chesterfield) Ireland St and Conwell, Huntington, Thrasher Hill, Higgins an South Worthington Rds		09/01/200	5 68
Wrentham			
Massachusetts State Hospitals and State Schools Multiple Property Submission, 14 districts and 1 DOE in 19 towns		01/21/199	4 95
Plimpton, Francis N Winter, Murray House 127 South St	NRIND	12/05/198	5 1
Roebuck Tavern	NRIND	12/05/198	5 1
21 Dedham St			
Warnelson Obele Coben l	NRDTS	01/21/199	4 95
Wrentham State School (Wrentham/Norfolk) Mass. State Hospitals and		01/21/199	
State Schools MFS, junction of Emerald and Nor			
Sts	2		
Yarmouth			
Baker, Judah Windmill	NRDIS	05/29/199	0 1
River St	PR	09/11/199	
	Exp:		

Delegation of Authority Form

Delegation of Authority

1 (nam	o) barabu darianata tha naman ayan a'f-alli	
below to be a duly authorized i	ne), hereby designate the person or specifically or representative for the purpose of overseeing con- cluding the Construction General Permit, at the	npliance with
	construction site. The designee is authorize	ed to sign any
reports, stormwater pollution pr	evention plans and all other documents required	by the permit.
	(name of person or position)	
	(company)	
	(address)	
	1-11 -1-1	
	(phone)	
direction or supervision in according properly gathered and evaluat or persons who manage the system information, the information subaccurate, and complete. I am information, including the possible pos	at this document and all attachments were prepared and with a system designed to assure that queed the information submitted. Based on my inquistem, or those persons directly responsible for gas smitted is, to the best of my knowledge and belief aware that there are significant penalties for subbility of fine and imprisonment for knowing violations.	valified personnel uiry of the person thering the ef, true, omitting false
Name:	 :	
Company:	12.0 	
Title:	8	
Signature:		
oignoide.		
Date:	1 80	

Subcontractor Certifications/Agreements

Project Number:

SUBCONTRACTOR CERTIFICATION STORMWATER POLLUTION PREVENTION PLAN

	177			
Operator(s):		74111111111111111111111111111111111111		
any work that you perfo subject to substantial pe	orm on-site. Any person or enalties or loss of contract of the requirements of the	r group who violates any of t. You are encouraged to	on Prevention Plan (SWP) condition of the SWPPP m advise each of your emplo SWPPP is available for you	nay be
Each subcontractor engiteentified and sign the fo	aged in activities at the co ollowing certification state	onstruction site that could ment:	impact stormwater must b	oe
I certify under the pen SWPPP for the above the SWPPP.	alty of law that I have re designated project and	ad and understand the t agree to follow the BMP	erms and conditions of sand practices describe	the ed in
This certification is here	hy signed in reference to	the above named project:	2 2	
	by signed in reference to	52 75		
Company:				
Company:				
Company:				
Company: Address: Telephone Number:				
Company: Address: Telephone Number: Type of construction sen				

National Pollutant Discharge Elimination System General Permit for Discharges from Construction Activities

In compliance with the provisions of the Clean Water Act, 33 U.S.C. §1251 et. seq., (hereafter CWA or the Act), as amended by the Water Quality Act of 1987, P.L. 100-4, "operators" of construction activities (defined in Part 1.1.a and Appendix A) that meet the requirements of Part 1.1 of this National Pollutant Discharge Elimination System (NPDES) general permit, are authorized to discharge pollutants in accordance with the effluent limitations and conditions set forth herein. Permit coverage is required from the "commencement of earth-disturbing activities" (see Appendix A) until "final stabilization" (see Part 2.2).

This permit becomes effective on February 16, 2012.

This permit and the authorization to discharge expire at midnight, February 16, 2017.

Signed and issued this 16th day of February, 2012

H. Curtis Spalding Regional Administrator, Region 1

Signed and issued this 16th day of February, 2012

John Filippelli Director, Division of Environmental Planning & Protection, Region 2

Signed and issued this 16th day of February, 2012

José C. Font Acting Division Director, Carribbean Environmental Protection Division, Region 2, Caribbean Office

Region 3

Signed and issued this 16th day of February, 2012
Catherine A. Libertz
Assistant Director, Water Protection Division,

Signed and issued this 16th day of February, 2012 James D. Giattina

Director, Water Protection Division, Region 4

Signed and issued this 16th day of February, 2012 Tinka G. Hyde Director, Water Division, Region 5 Signed and issued this 16th day of February, 2012

William K. Honker, P.E. Acting Director, Water Quality Prote

Acting Director, Water Quality Protection Division, Region 6

Signed and issued this 16th day of February, 2012

Karen Flournoy Director, Wetlands and Pesticides Division, Region

Signed and issued this 16th day of February, 2012

Melanie L. Pallman Acting Assistant Regional Administrator, Office of Partneships and Regulatory Assistance, Region 8

Signed and issued this 16th day of February, 2012

Nancy Woo Deputy Director, Water Division, Region 9

Signed and issued this 16th day of February, 2012

Michael J. Lidgard Acting Director, Office of Water and Watersheds, Region 10

The signatures are for the permit conditions in Parts 1 through 9 and Appendices A through K.

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HOW TO OBTAIN PERMIT COVERAGE UNDER THE CGP.

To be covered under this permit, you must meet the eligibility conditions and follow the requirements for applying for permit coverage in this Part.

1.1. ELIGIBILITY CONDITIONS REQUIRED OF ALL PROJECTS.

Only those projects that meet all of the following eligibility conditions may be covered under this permit:

 You are an "operator" of the construction project for which discharges will be covered under this permit;

Note: For the purposes of this permit, an "operator" is any party associated with a construction project that meets either of the following two criteria:

- The party has operational control over construction plans and specifications, including the ability to make modifications to those plans and specifications; or
- The party has day-to-day operational control of those activities at a project that are necessary to ensure compliance with the permit conditions (e.g., they are authorized to direct workers at a site to carry out activities required by the permit).

Subcontractors generally are not considered operators for the purposes of this permit.

Note: Where there are multiple operators associated with the same project, all operators are required to obtain permit coverage. The following applies in these situations:

- If one operator has control over plans and specifications and a different operator has control over activities at the project site, they may divide responsibility for compliance with the terms of this permit as long as they develop a group SWPPP (see Part 7.1.1), which documents which operator has responsibility for each requirement of the permit.
- 2. If an operator only has operational control over a portion of a larger project (e.g., one of four homebuilders in a subdivision), the operator is responsible for compliance with all applicable effluent limits, terms, and conditions of this permit as it relates to the activities on their portion of the construction site, including protection of endangered species, critical habitat, and historic properties, and implementation of control measures described in the SWPPP in the areas under their control.
- You must ensure either directly or through coordination with other permittees, that your activities do not render another party's pollutant discharge controls ineffective.
- If the operator of a "construction support activity" (see Part 1.3.c) is different than the operator of the main construction site, that operator is also required to obtain permit coverage.

b. Your project:

- Will disturb 1 or more acres of land, or will disturb less than 1 acre of land but is part of a common plan of development or sale that will ultimately disturb 1 or more acres of land; or
- ii. Your project's discharges have been designated by EPA as needing a permit under § 122.26(a)(1)(v) or § 122.26(b)(15)(ii);
- Your project is located in an area where EPA is the permitting authority (see Appendix B);

- d. Discharges from your project are not:
 - Already covered by a different NPDES permit for the same discharge; or
 - ii. In the process of having coverage under a different NPDES permit for the same discharge denied, terminated, or revoked.^{1, 2}
- You are able to demonstrate that you meet one of the criteria listed in Appendix D
 with respect to the protection of species that are federally-listed as endangered or
 threatened under the Endangered Species Act (ESA) or federally-designated
 critical habitat;
- You have completed the screening process in Appendix E relating to the protection of historic properties and places; and
- g. You have complied with all requirements in Part 9 imposed by the applicable state, Indian tribe, or territory in which your construction activities will occur.

1.2. ELIGIBILITY CONDITIONS THAT APPLY DEPENDING ON TYPE OF PROJECT.

You must also satisfy, if applicable, the conditions in Parts 1.2.1 through 1.2.4 in order to obtain coverage under this permit.

1.2.1. Eligibility for Emergency-Related Construction Activities.

If you are conducting earth-disturbing activities in response to a public emergency (e.g., natural disaster, widespread disruption in essential public services), and the related work requires immediate authorization to avoid imminent endangerment to human health, public safety, or the environment, or to reestablish essential public services, you are authorized to discharge on the condition that a complete and accurate NOI is submitted within 30 calendar days after commencing earth-disturbing activities (see Table 1) establishing that you are eligible under this permit. You are also required to provide documentation in your SWPPP to substantiate the occurrence of the public emergency.

1.2.2. Water Quality Standards – Eligibility for New Sources.

If you are a "new source" (as defined in Appendix A), you are not eligible for coverage under this permit for discharges that EPA, prior to authorization under this permit, determines will cause, have the reasonable potential to cause, or contribute to an excursion above any applicable water quality standard. Where such a determination is made prior to authorization, EPA may notify you that an individual permit application is necessary in accordance with Part 1.4.5. However, EPA may authorize your coverage under this permit after you have included appropriate controls and implementation procedures designed to bring your discharge into compliance with water quality standards. In the absence of information demonstrating otherwise, EPA expects that compliance with the stormwater control requirements of this permit, including the requirements applicable to such discharges in Part 3.2, will result in discharges that will not cause, have the reasonable potential to cause, or contribute to an excursion above any applicable water quality standard.

¹ Parts 1.1.d.i and 1.1.d.ii do not include sites currently covered under the 2003 or 2008 CGPs, which are in the process of obtaining coverage under this permit, and sites covered under this permit, which are transferring coverage to a different operator.

Notwithstanding a project being made ineligible for coverage under this permit because it falls under the description of Parts 1.1.d.i or 1.1.d.ii, above, EPA may waive the applicable requirement after specific review if it determines that coverage under this permit is appropriate.

1.2.3. Discharging to Waters with High Water Quality – Eligibility for New Sources.

If you are a "new source" (as defined in Appendix A), you are eligible to discharge to a Tier 2. Tier 2.5, or Tier 3 water only if your discharge will not lower the water quality of the applicable water. In the absence of information demonstrating otherwise, EPA expects that compliance with the stormwater control requirements of this permit, including the requirements applicable to such discharges in Part 3.3.2, will result in discharges that will not lower the water quality of the applicable water. See list of Tier 2, Tier 2.5, and Tier 3 waters in Appendix F.

Note: Your project will be considered to discharge to a Tier 2, Tier 2.5, or Tier 3 water if the first surface water to which you discharge is identified by a state, tribe, or EPA as a Tier 2, Tier 2.5, or Tier 3 water. For discharges that enter a storm sewer system prior to discharge, the first surface water to which you discharge is the waterbody that receives the stormwater discharge from the storm sewer system.

1.2.4. Use of Cationic Treatment Chemicals.

If you plan to use cationic treatment chemicals (as defined in Appendix A), you are ineligible for coverage under this permit, unless you notify your applicable EPA Regional Office in advance and the EPA office authorizes coverage under this permit after you have included appropriate controls and implementation procedures designed to ensure that your use of cationic treatment chemicals will not lead to a violation of water quality standards.

1.3. Types of Discharges Authorized Under the CGP.

The following is a list of discharges that are allowed under the permit provided that appropriate stormwater controls are designed, installed, and maintained:

- Stormwater discharges, including stormwater runoff, snowmelt runoff, and surface runoff and drainage, associated with construction activity under 40 CFR § 122.26(b)(14) or § 122.26(b)(15)(i);
- Stormwater discharges designated by EPA as needing a permit under 40 CFR § 122.26(a)(1)(v) or § 122.26(b)(15)(ii);
- c. Stormwater discharges from construction support activities (e.g., concrete or asphalt batch plants, equipment staging yards, material storage areas, excavated material disposal areas, borrow areas) provided:
 - The support activity is directly related to the construction site required to have permit coverage for stormwater discharges;
 - The support activity is not a commercial operation, nor does it serve multiple unrelated construction projects;
 - iii. The support activity does not continue to operate beyond the completion of the construction activity at the project it supports; and
 - Stormwater controls are implemented in accordance with Part 2 and, if applicable, Part 3, for discharges from the support activity areas.
- d. The following non-stormwater discharges from your construction activity, provided that, with the exception of water used to control dust and to irrigate areas to be vegetatively stabilized, these discharges are not routed to areas of exposed soil on your site and you comply with any applicable requirements for these discharges in Part 2:
 - Discharges from emergency fire-fighting activities;

- ii. Fire hydrant flushings;
- iii. Landscape irrigation;
- iv. Water used to wash vehicles and equipment, provided that there is no discharge of soaps, solvents, or detergents used for such purposes;
- v. Water used to control dust;
- vi. Potable water including uncontaminated water line flushings;
- vii. Routine external building washdown that does not use detergents;
- viii. Pavement wash waters provided spills or leaks of toxic or hazardous materials have not occurred (unless all spill material has been removed) and where detergents are not used. You are prohibited from directing pavement wash waters directly into any surface water, storm drain inlet, or stormwater conveyance, unless the conveyance is connected to a sediment basin, sediment trap, or similarly effective control;
- ix. Uncontaminated air conditioning or compressor condensate;
- x. Uncontaminated, non-turbid discharges of ground water or spring water;
- Foundation or footing drains where flows are not contaminated with process materials such as solvents or contaminated ground water; and
- xii. Construction dewatering water that has been treated by an appropriate control under Part 2.1.3.4; and
- Discharges of stormwater listed above in Parts a, b, and c, or authorized nonstormwater discharges in Part d above, commingled with a discharge authorized by a different NPDES permit and/or a discharge that does not require NPDES permit authorization.

1.4. SUBMITTING YOUR NOTICE OF INTENT (NOI).

To be covered under this permit, you must submit to EPA a complete and accurate NOI prior to commencing construction activities. The NOI certifies to EPA that you are eligible for coverage according to Part 1.1 and 1.2, and provides information on your construction operation and discharge.

- Note: All "operators" (as defined in Appendix A) associated with your construction project, who meet the Part 1.1 eligibility requirements, and who elect to seek coverage under this permit, are required to submit an NOI.
- Note: There are two exceptions to the requirement to submit the NOI prior to the commencement of construction activities: (1) for emergency-related projects, and (2) for new projects scheduled to commence construction activities on or after February 16, 2012, but no later than March 1, 2012. For these two types of projects, the NOI must be submitted within 30 calendar days after the commencement of earth-disturbing activities (see Part 1.4.2).
- Note: You must complete the development of a Stormwater Pollution Prevention Plan (SWPPP) consistent with Part 7 prior to submitting your NOI for coverage under this permit.

1.4.1. How to Submit Your NOI.

You are required to use EPA's electronic NOI system, or "eNOI system", to prepare and submit your NOI. Go to www.epa.gov/npdes/stormwater/cgpenoi to access the eNOI system and file an NOI. If you have a problem with the use of the eNOI system, contact

the EPA Regional Office that corresponds to the location of your site. If you are given approval by the EPA Regional Office to use a paper NOI, and you elect to use it, you must complete the form in Appendix J.

1.4.2. Deadlines for Submitting Your NOI and Your Official Date of Permit Coverage.

Table 1 provides the deadlines for submitting your NOI and your official start date of permit coverage, which differ depending on when you commence construction activities. The following terms are used in Table 1 to establish NOI deadlines:

- New project a construction project that commences construction activities on or after February 16, 2012.
- b. Existing project – a construction project that commenced construction activities prior to February 16, 2012.
- c. New operator of a new or existing project an operator that through transfer of ownership and/or operation replaces the operator of an already permitted construction project.

Type of Construction Project	Deadlines for Operators to Submit NOI	Official Start Date for Permit Coverage
New project	You must submit your NOI at least 14 calendar days prior to commencing earth-disturbing activities. Exception: If your project qualifies as an "emergency-related project" under Part 1.2.1, you must submit your NOI by no later than 30 calendar days after commencing earth-disturbing activities. Exception: If you are scheduled to commence construction activities on or after February 16, 2012, but no later than March 1, 2012, you must submit your NOI by no later than 30 calendar days after commencing earth-disturbing activities.	You are considered covered under this permit 14 calendar days after EPA has acknowledged receipt of your NOI on the Agency's website (www.epa.gov/npdes/stormwater/ogpnoisearch), unless EPA notifies you that your authorization has been delayed or denied. Exception: If your project qualifies as an "emergency-related project" under Part 1.2.1, you are considered provisionally covered under the terms and conditions of this permit immediately, and fully covered 14 calendar days after EPA has acknowledged receipt of your NOI, unless EPA notifies you that your authorization has been delayed or denied.
		Exception: If you are scheduled to commence construction activities on or after February 16, 2012, but no later than March 1, 2012, you are considered provisionally covered under the terms and conditions of this permit immediately, and fully covered 14 calendar days after EPA has acknowledged receipt of your NOI, unless EPA notifies you that your

Type of Construction Project	Deadlines for Operators to Submit NOI	Official Start Date for Permit Coverage	
		authorization has been delayed or denied.	
Existing project	You must submit your NOI by no later than May 16, 2012.3 However, if you have not previously obtained coverage under an NPDES permit, you must submit your NOI immediately.	You are considered covered under this permit 14 calendar days after EPA has acknowledged receipt of your NOI on the Agency's website (www.epa.gov/npdes/stormwater/capnoisearch), unless EPA notifies you that your authorization has been delayed or denied.4	
New operator of a new or existing project	You must submit your NOI at least 14 calendar days before the date the transfer to the new operator will take place.	You are considered covered under this permit 14 calendar days after EPA has acknowledged receipt of your NOI on the Agency's website (www.epa.gov/npdes/stormwater/capnoisearch), unless EPA notifies you that your authorization has been delayed or denied.	

Note: If you have missed the deadline to submit your NOI, any and all discharges from your construction activities will continue to be unauthorized under the Clean Water Act until they are covered by this or a different NPDES permit. EPA may take enforcement action for any unpermitted discharges that occur between the commencement of earth-disturbing activities and discharge authorization.

Note: Discharges are not authorized if your NOI is incomplete or inaccurate or if you were never eligible for permit coverage.

1.4.3. Your Official End Date of Permit Coverage

Once covered under this permit, your coverage will last until the date that:

- You terminate permit coverage consistent with Part 8; or
- Your discharges are permitted under a different NPDES permit or a reissued or replacement version of this permit after expiring on February 16, 2017; or
- For existing projects that continue after this permit has expired, the deadline has
 passed for the submission of an NOI for coverage under a reissued or
 replacement version of this permit and you have failed to submit an NOI by the
 required deadline.

1.4.4. Continuation of Coverage for Existing Permittees After the Permit Expires.

If this permit is not reissued or replaced prior to the expiration date, it will be administratively continued in accordance with the Administrative Procedure Act and

³ For existing projects located in the following areas, NOIs must be submitted no later than 90 days after the date of permit issuance: the State of Idaho (except Indian country); and areas in the State of Washington, except Indian country, subject to construction by a Federal Operator.

Note that if you are currently covered under the 2003 or 2008 CGP, this coverage continues until your coverage under this permit begins, provided you have submitted an NOI by the deadline.

remain in force and effect for discharges that were covered prior to expiration. If you were granted permit coverage prior to the expiration date, you will automatically remain covered by this permit until the earliest of:

Your authorization for coverage under a reissued or replacement version of this
permit following your timely submittal of a complete and accurate NOI
requesting coverage under the new permit; or

Note: If you fail to submit a timely NOI for coverage under the reissued or replacement permit, your coverage will terminate on the date that the NOI was due.

- Your submittal of a Notice of Termination; or
- Issuance or denial of an individual permit for the project's discharges; or
- A final permit decision by EPA not to reissue a general permit, at which time EPA
 will identify a reasonable time period for covered dischargers to seek coverage
 under an alternative general permit or an individual permit. Coverage under this
 permit will terminate at the end of this time period.

EPA reserves the right to modify or revoke and reissue this permit under 40 CFR 122.62 and 63, in which case you will be notified of any relevant changes or procedures to which you may be subject.

1.4.5. Procedures for Denial of Coverage.

Following your submittal of a complete and accurate NOI, you may be notified in writing by EPA that you are not covered, and that you must either apply for and/or obtain coverage under an individual NPDES permit or an alternate general NPDES permit. This notification will include a brief statement of the reasons for this decision and will provide application information. Any interested person may request that EPA consider requiring an individual permit under this paragraph.

If you are already a permittee with coverage under this permit, the notice will set a deadline to file the permit application, and will include a statement that on the effective date of the individual NPDES permit or alternate general NPDES permit, as it applies to you, coverage under this general permit will terminate. EPA may grant additional time to submit the application if you request it. If you are covered under this permit and fail to submit an individual NPDES permit application or an NOI for an alternate general NPDES permit as required by EPA, then the applicability of this permit to you is terminated at the end of the day specified by EPA as the deadline for application submittal. EPA may take appropriate enforcement action for any unpermitted discharge. If you submit a timely permit application, then when an individual NPDES permit is issued to you or you are provided with coverage under an alternate general NPDES permit, your coverage under this permit is terminated on the effective date of the individual permit or date of coverage under the alternate general permit.

REQUIREMENT TO POST A NOTICE OF YOUR PERMIT COVERAGE.

You must post a sign or other notice conspicuously at a safe, publicly accessible location in close proximity to the project site. At a minimum, the notice must include the NPDES Permit tracking number and a contact name and phone number for obtaining additional project information. The notice must be located so that it is visible from the public road that is nearest to the active part of the construction site, and it must use a font large enough to be readily viewed from a public right-of-way.

2. EFFLUENT LIMITATIONS APPLICABLE TO ALL DISCHARGES FROM CONSTRUCTION SITES

You are required to comply with the following effluent limitations in this Part for discharges from your site and/or from construction support activities (see Part 1.3.c).

Note: If your project is an "existing project" (see Part 1.4.2.b) or if you are a "new operator of an existing project" (see Part 1.4.2.c), and it is infeasible for you to comply with a specific requirement in this Part because (1) the requirement was not part of the permit you were previously covered under (i.e., the 2003 or 2008 CGP), and (2) because you are prevented from compliance due to the nature or location of earth disturbances that commenced prior to February 16, 2012, or because you are unable to comply with the requirement due to the manner in which stormwater controls have already been installed or were already designed prior to February 16, 2012, you are required to document this fact in your SWPPP and are waived from complying with that requirement. This flexibility applies only to the requirements in Parts 2.1, and 2.3.3 through 2.3.5 (except for Parts 2.3.3.1, 2.3.3.2b, 2.3.3.3c.i, and 2.3.3.4). This only applies to those portions of your site that have already commenced earth-disturbing activities or where stormwater controls implemented in compliance with the previous permit have already been installed.

Part 2 includes the following types of requirements:

- Erosion and Sediment Control Requirements (Part 2.1)
- Stabilization Requirements (Part 2.2)
 Pollution Prevention Requirements (Part 2.3)

2.1. EROSION AND SEDIMENT CONTROL REQUIREMENTS.

You must design, install, and maintain erosion and sediment controls that minimize the discharge of pollutants from earth-disturbing activities. To meet this requirement, you must comply with the following provisions.

2.1.1. General Requirements Applicable to All Construction Sites.

2.1.1.1 Area of Disturbance. You are required to minimize the amount of soil exposed during construction activities. You are also subject to the deadlines for temporarily and/or permanently stabilizing exposed portions of your site pursuant to Part 2.2.

2.1.1.2 Design Requirements.

- You must account for the following factors in designing your stormwater controls:
 - The expected amount, frequency, intensity, and duration of precipitation;
 - ii. The nature of stormwater runoff and run-on at the site, including factors such as expected flow from impervious surfaces, slopes, and site drainage features. If any stormwater flow will be channelized at your site, you must design stormwater controls to control both peak flowrates and total stormwater volume to minimize erosion at outlets and to minimize downstream channel and streambank erosion; and
 - iii. The range of soil particle sizes expected to be present on the site.
- You must direct discharges from your stormwater controls to vegetated areas of your site to increase sediment removal and maximize stormwater

infiltration, including any natural buffers established under Part 2.1.2.1, unless infeasible. Use velocity dissipation devices if necessary to prevent erosion when directing stormwater to vegetated areas.

2.1.1.3 Installation Requirements.

a. Complete installation of stormwater controls by the time each phase of earth-disturbance has begun, unless infeasible. By the time earth-disturbing activities in any given portion of your site have begun, unless infeasible, you must install and make operational any downgradient sediment controls (e.g., buffers or equivalent sediment controls, perimeter controls, exit point controls, storm drain inlet protection) that control discharges from the initial site clearing, grading, excavating, and other land-disturbing activities.

Note: Where it is infeasible to install stormwater controls prior to the initial earth disturbance, it is EPA's expectation that it will be a rare circumstance that will prevent the operator from installing such controls immediately following the initial earth disturbance.

Following the installation of these initial controls, all other stormwater controls planned for this portion of your site and described in your SWPPP must be installed and made operational as soon as conditions on the site allow.

Note: The requirement to install stormwater controls prior to earth-disturbance for each phase of the project does not apply to the earth disturbance associated with the actual installation of these controls.

Use good engineering practices and follow manufacturer's specifications.
 You must install all stormwater controls in accordance with good engineering practices, including applicable design specifications.

Note: Design specifications may be found in manufacturer specifications and/or in applicable erosion and sediment control manuals or ordinances. Any departures from such specifications must reflect good engineering practice and must be explained in your SWPPP.

2.1.1.4 Maintenance Requirements.

- b. You must inspect all erosion and sediment controls in accordance with the applicable requirements in Part 4.1, and document your findings in accordance with Part 4.1.7. If you find a problem (e.g., erosion and sediment controls need to be replaced, repaired, or maintained), you must make the necessary repairs or modifications in accordance with the following schedule:
 - Initiate work to fix the problem immediately after discovering the problem, and complete such work by the close of the next work day, if the problem does not require significant repair or replacement, or if the problem can be corrected through routine maintenance.
 - ii. When installation of a new erosion or sediment control or a significant repair is needed, you must install the new or modified control and make it operational, or complete the repair, by no later than 7 calendar days from the time of discovery where feasible. If it

is infeasible to complete the installation or repair within 7 calendar days, you must document in your records why it is infeasible to complete the installation or repair within the 7-day timeframe and document your schedule for installing the stormwater control(s) and making it operational as soon as practicable after the 7-day timeframe. Where these actions result in changes to any of the stormwater controls or procedures documented in your SWPPP, you must modify your SWPPP accordingly within 7 calendar days of completing this work.

- 2.1.2. Erosion and Sediment Control Requirements Applicable to All Sites.
 - 2.1.2.1 Provide Natural Buffers or Equivalent Sediment Controls. (These requirements only apply when a surface water is located within 50 feet of your project's earth disturbances).
 - Note: EPA does not consider stormwater control features (e.g., stormwater conveyance channels, storm drain inlets, sediment basins) to constitute "surface waters" for the purposes of triggering the requirement to comply with this Part.
 - Note: Areas that you do not own or that are otherwise outside your operational control may be considered areas of undisturbed natural buffer for purposes of compliance with this part.

You must ensure that any discharges to surface waters through the area between the disturbed portions of the property and any surface waters located within 50 feet of your site are treated by an area of undisturbed natural buffer and/or additional erosion and sediment controls in order to achieve a reduction in sediment load equivalent to that achieved by a 50-foot natural buffer. Refer to Appendix G (Buffer Guidance) for information to assist you in complying with this requirement, and to Part 2.1.2.1e for exceptions to this requirement.

- Compliance Alternatives. You can comply with this requirement in one
 of the following ways:
 - i. Provide and maintain a 50-foot undisturbed natural buffer; or

Note: If your earth disturbances are located 50 feet or further from a surface water, then you have complied with this alternative.

- Provide and maintain an undisturbed natural buffer that is less than 50 feet and is supplemented by additional erosion and sediment controls, which in combination achieves the sediment load reduction equivalent to a 50-foot undisturbed natural buffer; or
- iii. If it is infeasible to provide and maintain an undisturbed natural buffer of any size, you must implement erosion and sediment controls that achieve the sediment load reduction equivalent to a 50-foot undisturbed natural buffer.

Note: For the compliance alternatives in Parts 2.1.2.1a.i and 2.1.2.1a.ii, you are not required to enhance the quality of the vegetation that already exists in the buffer, or provide vegetation if none exists (e.g., arid and semi-arid areas). You only need to retain and protect from disturbance the natural buffer that existed prior to the commencement of construction. Any preexisting structures or impervious surfaces are allowed in the natural buffer provided you retain and

protect from disturbance the natural buffer area outside the preexisting disturbance. Similarly, for alternatives 2.1.2.1a.ii and 2.1.2.1a.iii, you are required to implement and maintain sediment controls that achieve the sediment load reduction equivalent to the undisturbed natural buffer that existed on the site prior to the commencement of construction. In determining equivalent sediment load reductions, you may consider naturally non-vegetated areas and prior disturbances. See Appendix G for a discussion of how to determine equivalent reductions.

You must document the compliance alternative you have selected in your SWPPP, and comply with the applicable additional requirements described in Parts 2.1.2.1b and 2.1.2.1c below.

The compliance alternative selected above must be maintained throughout the duration of permit coverage, except that you may select a different compliance alternative during your period of permit coverage, in which case you must modify your SWPPP to reflect this change.

- b. Additional Requirements for the Compliance Alternatives in Parts 2.1.2.1a.i and 2.1.2.1a.ii. If you choose either of the compliance alternatives in Parts 2.1.2.1a.ii or 2.1.2.1a.ii above, throughout your period of coverage under this permit, you must comply with the following additional requirements:
 - Ensure that all discharges from the area of earth disturbance to the natural buffer are first treated by the site's erosion and sediment controls, and use velocity dissipation devices if necessary to prevent erosion caused by stormwater within the buffer;
 - Document in your SWPPP the natural buffer width retained on the property, and show the buffer boundary on your site plan; and
 - Delineate, and clearly mark off, with flags, tape, or other similar marking device all natural buffer areas.
- c. Additional Requirements for the Compliance Alternatives in Parts 2.1.2.1a.ii and 2.1.2.1a.iii. If you choose either of the compliance alternatives in Parts 2.1.2.1a.ii and 2.1.2.1a.iii, you must document in your SWPPP the erosion and sediment control(s) you will use to achieve an equivalent sediment reduction, and any information you relied upon to demonstrate the equivalency.
- d. Additional Requirement for the Compliance Alternative in Part 2.1.2.1a.iii. If you choose the compliance alternative in Part 2.1.2.1a.iii, you must also include in your SWPPP a description of why it is infeasible for you to provide and maintain an undisturbed natural buffer of any size.
- e. Exceptions.
 - i. If there is no discharge of stormwater to surface waters through the area between your site and any surface waters located within 50 feet of your site, you are not required to comply with the requirements in this Part. This includes situations where you have implemented control measures, such as a berm or other barrier, that will prevent such discharges.

ii. Where no natural buffer exists due to preexisting development disturbances (e.g., structures, impervious surfaces) that occurred prior to the initiation of planning for the current development of the site, you are not required to comply with the requirements in this Part, unless you will remove portions of the preexisting development.

Where some natural buffer exists but portions of the area within 50 feet of the surface water are occupied by preexisting development disturbances, you are required to comply with the requirements in this Part. For the purposes of calculating the sediment load reduction for either Part 2.1.2.1a.ii or 2.1.2.1a.iii above, you are not expected to compensate for the reduction in buffer function from the area covered by these preexisting disturbances. See Appendix G for further information on how to comply with the compliance alternatives in Part 2.1.2.1a.ii or 2.1.2.1a.iii above.

If during your project, you will disturb any portion of these preexisting disturbances, the area disturbed will be deducted from the area treated as natural buffer.

- iii. For "linear construction projects" (see Appendix A), you are not required to comply with the requirements in this Part if site constraints (e.g., limited right-of-way) prevent you from meeting any of the compliance alternatives in Part 2.1.2.1a, provided that, to the extent practicable, you limit disturbances within 50 feet of the surface water and/or you provide supplemental erosion and sediment controls to treat stormwater discharges from earth disturbances within 50 feet of the surface water. You must also document in your SWPPP your rationale as to why it is infeasible for you to comply with the requirements in Part 2.1.2.1a, and describe any buffer width retained and/or supplemental erosion and sediment controls installed.
- iv. For "small residential lot" construction (i.e., a lot being developed for residential purposes that will disturb less than 1 acre of land, but is part of a larger residential project that will ultimately disturb greater than or equal to 1 acre), you have the option of complying with the requirements in Appendix G (Part G.2.3).
- v. The following disturbances within 50 feet of a surface water are exempt from the requirements in this Part:
 - Construction approved under a CWA Section 404 permit; or
 - Construction of a water-dependent structure or water access area (e.g., pier, boat ramp, trail).

You must document in your SWPPP if any of the above disturbances will occur within the buffer area on your site.

2.1.2.2 Install Perimeter Controls.

 Installation Requirements: You must install sediment controls along those perimeter areas of your site that will receive stormwater from earthdisturbing activities.⁵

⁵ Examples of perimeter controls include, but are not limited to, filter berms, silt fences, and temporary diversion dikes.

For linear projects with rights-of-way that restrict or prevent the use of such perimeter controls, you must maximize the use of these controls where practicable and document in your SWPPP why it is impracticable in other areas of the project.

- Maintenance Requirements: You must remove sediment before it has accumulated to one-half of the above-ground height of any perimeter control.
- 2.1.2.3 Minimize Sediment Track-Out. You must minimize the track-out of sediment onto off-site streets, other paved areas, and sidewalks from vehicles exiting your construction site. To comply with this requirement, you must:
 - Restrict vehicle use to properly designated exit points;
 - Use appropriate stabilization techniques at all points that exit onto paved roads so that sediment removal occurs prior to vehicle exit;
 - Where necessary, use additional controls⁷ to remove sediment from vehicle tires prior to exit; and
 - d. Where sediment has been tracked-out from your site onto the surface of off-site streets, other paved areas, and sidewalks, you must remove the deposited sediment by the end of the same work day in which the track-out occurs or by the end of the next work day if track-out occurs on a non-work day. You must remove the track-out by sweeping, shoveling, or vacuuming these surfaces, or by using other similarly effective means of sediment removal. You are prohibited from hosing or sweeping tracked-out sediment into any stormwater conveyance (unless it is connected to a sediment basin, sediment trap, or similarly effective control), storm drain inlet, or surface water.

Note: EPA recognizes that some fine grains may remain visible on the surfaces of off-site streets, other paved areas, and sidewalks even after you have implemented sediment removal practices. Such "staining" is not a violation of Part 2.1.2.3.

2.1.2.4 Control Discharges from Stockpiled Sediment or Soil. For any stockpiles or land clearing debris composed, in whole or in part, of sediment or soil, you must comply with the following requirements:

Note: For the purposes of this permit, sediment or soil stockpiles are defined as the storage for multiple days of soil or other sediment material to be used in the construction project.

- a. Locate the piles outside of any natural buffers established under Part 2.1.2.1a and physically separated from other stormwater controls implemented in accordance with Part 2.1;
- Protect from contact with stormwater (including run-on) using a temporary perimeter sediment barrier;8

Examples of appropriate stabilization techniques include the use of aggregate stone with an underlying geotextile or non-woven filter fabric, or turf mats.

Examples of additional controls to remove sediment from vehicle tires include, but are not limited to, wheel washing, rumble strips, and rattle plates.

⁸ Examples include berms, dikes, fiber rolls, silt fences, sandbag, gravel bags, or straw bale.

- Where practicable, provide cover or appropriate temporary stabilization to avoid direct contact with precipitation or to minimize sediment discharge;
- Do not hose down or sweep soil or sediment accumulated on pavement or other impervious surfaces into any stormwater conveyance (unless connected to a sediment basin, sediment trap, or similarly effective control), storm drain inlet, or surface water; and
- Unless infeasible, contain and securely protect from wind.
- 2.1.2.5 Minimize Dust. In order to avoid pollutants from being discharged into surface waters, to the extent feasible, you must minimize the generation of dust through the appropriate application of water or other dust suppression techniques.
- 2.1.2.6 Minimize the Disturbance of Steep Slopes. You must minimize the disturbance of "steep slopes" (see definition in Appendix A).
 - Note: The permit does not prevent or prohibit disturbance on steep slopes. For some projects, disturbance on steep slopes may be necessary for construction (e.g., a road cut in mountainous terrain). If a disturbance to steep slopes is required for the project, EPA would recognize that it is not economically achievable to avoid the disturbance to steep slopes. However, in cases where steep slope disturbances are required, minimizing the disturbances to steep slopes consistent with this requirement can be accomplished through the implementation of a number of standard erosion and sediment control practices, such as by phasing disturbances to these areas and using stabilization practices designed to be used on steep grades.
- 2.1.2.7 Preserve Topsoil. You must preserve native topsoil on your site, unless infeasible.
 - Note: Some projects may be designed to be highly impervious after construction, and therefore little or no vegetation is intended to remain. In these cases, preserving topsoil at the site would not be feasible. Some sites may not have space to stockpile topsoil on site for later use, in which case, it may also not be feasible to preserve topsoil.
 - Note: Stockpiling of topsoil at off-site locations, or transfer of topsoil to other locations, is an example of a practice that is consistent with the requirements in this Part.
- 2.1.2.8 Minimize Soil Compaction. In areas of your site where final vegetative stabilization will occur or where infiltration practices will be installed, you must either:
 - Restrict vehicle / equipment use. Restrict vehicle and equipment use in these locations to avoid soil compaction; or
 - b. Use soil conditioning techniques. Prior to seeding or planting areas of exposed soil that have been compacted, use techniques that condition the soils to support vegetative growth, if necessary and feasible.
 - 2.1.2.9 Protect Storm Drain Inlets. If you discharge to any storm drain inlet that carries stormwater flow from your site directly to a surface water (and it is not first directed to a sediment basin, sediment trap, or similarly effective control), and you have authority to access the storm drain inlet, you must:

 a. Installation Requirements. Install inlet protection measures⁹ that remove sediment from your discharge prior to entry into the storm drain inlet.

Note: Inlet protection measures can be removed in the event of flood conditions or to prevent erosion.

- b. Maintenance Requirements. Clean, or remove and replace, the protection measures as sediment accumulates, the filter becomes clogged, and/or performance is compromised. Where there is evidence of sediment accumulation adjacent to the inlet protection measure, you must remove the deposited sediment by the end of the same work day in which it is found or by the end of the following work day if removal by the same work day is not feasible.
- 2.1.3. Requirements Applicable Only to Sites Using These Specific Stormwater Controls.

You are required to comply with the following requirements if you will install any of the following stormwater controls at your site:

- 2.1.3.1 Constructed Stormwater Conveyance Channels. Design stormwater conveyance channels to avoid unstabilized areas on the site and to reduce erosion, unless infeasible. Minimize erosion of channels and their embankments, outlets, adjacent streambanks, slopes, and downstream waters during discharge conditions through the use of erosion controls and velocity dissipation devices¹⁰ within and along the length of any constructed stormwater conveyance channel, and at any outlet to provide a non-erosive flow velocity.
- 2.1.3.2 Sediment Basins. If you install a sediment basin, you must comply with the following:
 - Design requirements.
 - Provide storage for either (1) the calculated volume of runoff from a 2-year, 24-hour storm (see Appendix H), or (2) 3,600 cubic feet per acre drained;
 - ii. When discharging from the sediment basin, utilize outlet structures that withdraw water from the surface in order to minimize the discharge of pollutants, unless infeasible;

Note: EPA believes that the circumstances in which it is infeasible to design outlet structures in this manner are rare. Exceptions may include areas with extended cold weather, where surface outlets may not be feasible during certain time periods (although it is expected that they would be used during other periods). If you have determined that it is infeasible to meet this requirement, you must provide documentation in your SWPPP to support your determination.

iii. Prevent erosion of (1) the sediment basin using stabilization controls (e.g., erosion control blankets), and (2) the inlet and outlet using erosion controls and velocity dissipation devices; and

⁹ Examples of inlet protection measures include fabric filters, sandbags, concrete blocks, and gravel barriers.

Examples of velocity dissipation devices include check dams, sediment traps, riprap, or grouted riprap at outlets.

- iv. Sediment basins must be situated outside of surface waters and any natural buffers established under Part 2.1.2.1a, and must be designed to avoid collecting water from wetlands.
- b. Maintenance requirements. Keep in effective operating condition and remove accumulated sediment to maintain at least ½ of the design capacity of the sediment basin at all times.
- 2.1.3.3 Use of Treatment Chemicals. If you are using polymers, flocculants, or other treatment chemicals at your site, you must comply with the following minimum requirements:
 - a. Use conventional erosion and sediment controls prior to and after the application of treatment chemicals. Use conventional erosion and sediment controls prior to chemical addition to ensure effective treatment. Chemicals may only be applied where treated stormwater is directed to a sediment control (e.g., sediment basin, perimeter control) prior to discharge.
 - b. Select appropriate treatment chemicals. Chemicals must be selected that are appropriately suited to the types of soils likely to be exposed during construction and discharged to locations where chemicals will be applied, and to the expected turbidity, pH, and flow rate of stormwater flowing into the chemical treatment system or area.
 - c. Minimize discharge risk from stored chemicals. Store all treatment chemicals in leak-proof containers that are kept under storm-resistant cover and surrounded by secondary containment structures (e.g., spill berms, decks, spill containment pallets), or provide equivalent measures, designed and maintained to minimize the potential discharge of treatment chemicals in stormwater or by any other means (e.g., storing chemicals in covered area or having a spill kit available on site).
 - Comply with state/local requirements. Comply with relevant state and local requirements affecting the use of treatment chemicals.
 - e. Use chemicals in accordance with good engineering practices and specifications of the chemical provider/supplier. You must also use treatment chemicals and chemical treatment systems in accordance with good engineering practices, and with dosing specifications and sediment removal design specifications provided by the provider/supplier of the applicable chemicals, or document specific departures from these practices or specifications and how they reflect good engineering practice.
 - f. Ensure proper training. Ensure that all persons who handle and use treatment chemicals at the construction site are provided with appropriate, product-specific training. Among other things, the training must cover proper dosing requirements.
 - g. Comply with additional requirements for the approved use of cationic chemicals. If you have been authorized to use cationic chemicals at your site pursuant to Part 1.2.4, and the authorization is conditioned on your compliance with additional requirements necessary to ensure that the use of such chemicals will not cause an exceedance of water quality standards, you are required to comply with all such requirements.

- h. Provide proper SWPPP documentation. You must include documentation in your SWPPP consistent with Parts 7.2.6.9 and 7.2.10.2 on the specific chemicals and chemical treatment systems you will use, and how you will comply with the requirements in this Part.
- 2.1.3.4 Dewatering Practices. You are prohibited from discharging ground water or accumulated stormwater that is removed from excavations, trenches, foundations, vaults, or other similar points of accumulation, unless such waters are first effectively managed by appropriate controls.¹¹ Uncontaminated, non-turbid dewatering water can be discharged without being routed to a control.

You must also meet the following requirements for dewatering activities:

- Discharge requirements.
 - i. Do not discharge visible floating solids or foam;
 - Use an oil-water separator or suitable filtration device (such as a cartridge filter) that is designed to remove oil, grease, or other products if dewatering water is found to contain these materials;
 - To the extent feasible, utilize vegetated, upland areas of the site to infiltrate dewatering water before discharge. In no case will surface waters be considered part of the treatment area;
 - iv. At all points where dewatering water is discharged, comply with the velocity dissipation requirements of Part 2.1.3.1;
 - With backwash water, either haul it away for disposal or return it to the beginning of the treatment process; and
 - vi. Replace and clean the filter media used in dewatering devices when the pressure differential equals or exceeds the manufacturer's specifications.
- Treatment chemical restrictions. If you are using polymers, flocculants, or other treatment chemicals to treat dewatering water, you must comply with the requirements in Parts 2.1.3.3.

2.2. STABILIZATION REQUIREMENTS.

You are required to stabilize exposed portions of your site in accordance with the requirements of this Part.

Note: For the purposes of this permit, "exposed portions of your site" means areas of exposed soil that are required to be stabilized. Note that EPA does not expect that temporary or permanent stabilization measures to be applied to areas that are intended to be left unvegetated or unstabilized following construction (e.g., dirt access roads, utility pole pads, areas being used for storage of vehicles, equipment, or materials).

2.2.1. Deadlines for Initiating and Completing Stabilization.

2.2.1.1 Deadline to Initiate Stabilization. You must initiate soil stabilization measures immediately whenever earth-disturbing activities have permanently or temporarily ceased on any portion of the site.

¹¹ Examples of appropriate controls include, but are not limited to, sediment basins or sediment traps, sediment socks, dewatering tanks, tube settlers, weir tanks, or filtration systems (e.g., bag or sand filters) that are designed to remove sediment.

Note: Earth-disturbing activities have permanently ceased when clearing and excavation within any area of your construction site that will not include permanent structures has been completed.

Note: Earth-disturbing activities have temporarily ceased when clearing, grading, and excavation within any area of the site that will not include permanent structures will not resume (i.e., the land will be idle) for a period of 14 or more calendar days, but such activities will resume in the future.

The 14 calendar day timeframe above begins counting as soon as you know that construction work on a portion of your site will be temporarily ceased. In circumstances where you experience unplanned or unanticipated delays in construction due to circumstances beyond your control (e.g., sudden work stoppage due to unanticipated problems associated with construction labor, funding, or other issues related to the ability to work on the site; weather conditions rendering the site unsuitable for the continuation of construction work) and you do not know at first how long the work stoppage will continue, your requirement to immediately initiate stabilization is triggered as soon as you know with reasonable certainty that work will be stopped for 14 or more additional calendar days. At that point, you must comply with Parts 2.2.1.1 and 2.2.1.2.

Note: For the purposes of this permit, EPA will consider any of the following types of activities to constitute the initiation of stabilization:

- 1. prepping the soil for vegetative or non-vegetative stabilization;
- 2. applying mulch or other non-vegetative product to the exposed area;
- 3. seeding or planting the exposed area;
- starting any of the activities in # 1 3 on a portion of the area to be stabilized, but not on the entire area; and
- finalizing arrangements to have stabilization product fully installed in compliance with the applicable deadline for completing stabilization in Parts 2.2.1.2 and 2.2.1.3.

This list of examples is not exhaustive.

Note: The term "immediately" is used to define the deadline for initiating stabilization measures. In the context of this provision, "immediately" means as soon as practicable, but no later than the end of the next work day, following the day when the earth-disturbing activities have temporarily or permanently ceased.

- 2.2:1.2 Deadline to Complete Stabilization Activities. As soon as practicable, but no later than 14 calendar days after the initiation of soil stabilization measures consistent with Part 2.2.1.1¹², you are required to have completed:
 - a. For vegetative stabilization, all activities 13 necessary to initially seed or plant the area to be stabilized; and/or
 - For non-vegetative stabilization, the installation or application of all such non-vegetative measures.

EPA may determine, based on an inspection carried out under Part 4.2 and corrective actions required under Part 5.3, that the level of sediment discharge on the site makes it necessary to require a faster schedule for completing stabilization. For instance, if sediment discharges from an area of exposed soil that is required to be stabilized are compromising the performance of existing stormwater controls, EPA may require stabilization to correct this problem.

¹³ For example, such activities might include, but are not limited to, soil conditioning, application of seed or sod, planting of seedlings or other vegetation, application of fertilizer, and, as deemed appropriate, watering.

2.2.1.3 Exceptions to the Deadlines for Initiating and Completing Stabilization.

- a. Deadlines for projects occurring in arid or semi-arid areas, or droughtstricken areas. These requirements apply if (1) your site is located in an
 arid area, a semi-arid area, or a drought-stricken area, as these terms are
 defined in Appendix A, (2) construction will occur during the seasonally
 dry period or during a period in which drought is predicted to occur, and
 (3) you are using vegetative cover for temporary or permanent
 stabilization. You may also comply with the deadlines in Part 2.2.1.1
 instead. The deadlines for these types of projects are as follows:
 - Immediately initiate, and within 14 calendar days of a temporary or permanent cessation of work in any portion of your site complete, the installation of temporary non-vegetative stabilization measures to the extent necessary to prevent erosion;
 - ii. As soon as practicable, given conditions or circumstances on your site, complete all activities necessary to initially seed or plant the area to be stabilized; and
 - iii. If construction is occurring during the seasonally dry period, indicate in your SWPPP the beginning and ending dates of the seasonally dry period and your site conditions. You must also include the schedule you will follow for initiating and completing vegetative stabilization.
- b. Deadlines for projects that are affected by circumstances beyond the control of the permittee that delay the initiation and/or completion of vegetative stabilization as required in Parts 2.2.1.1 and/or 2.2.1.2. If you are unable to meet the deadlines in Parts 2.2.1.1 and/or 2.2.1.2 due to circumstances beyond your control¹⁴, and you are using vegetative cover for temporary or permanent stabilization, you may comply with the following stabilization deadlines instead:
 - Immediately initiate, and within 14 calendar days complete, the installation of temporary non-vegetative stabilization measures to prevent erosion;
 - ii. Complete all soil conditioning, seeding, watering or irrigation installation, mulching, and other required activities related to the planting and initial establishment of vegetation as soon as conditions or circumstances allow it on your site; and

Note: You are required to have stabilized the exposed portions of your site consistent with Part 2.2.2 prior to terminating permit coverage under Part 8.2.

- iii. Document the circumstances that prevent you from meeting the deadlines required in Parts 2.2.1.1 and/or 2.2.1.2 and the schedule you will follow for initiating and completing stabilization.
- c. Deadlines for sites discharging to sensitive waters. For any portion of the site that discharges to a sediment or nutrient-impaired water (see Part 3.2) or to a water that is identified by your state, tribe, or EPA as Tier 2, Tier 2.5, or Tier 3 for antidegradation purposes (see Part 3.3), you are required

Examples include problems with the supply of seed stock or with the availability of specialized equipment, unsuitability of soil conditions due to excessive precipitation and/or flooding.

to complete the stabilization activities specified in Parts 2.2.1.2a and/or 2.2.1.2b within 7 calendar days after the temporary or permanent cessation of earth-disturbing activities.

Note: If you qualify for the deadlines for initiating and completing stabilization in Part 2.2.1.3a or b, you may comply with the stabilization deadlines in Part 2.2.1.3a or b for any portion of your site that discharges to a sensitive water.

2.2.2. Criteria for Stabilization.

To be considered adequately stabilized, you must meet the criteria below depending on the type of cover you are using, either vegetative or non-vegetative.

2.2.2.1 Vegetative Stabilization.

- For all sites, except those located in arid or semi-arid areas or on agricultural lands.
 - i. If you are vegetatively stabilizing any exposed portion of your site through the use of seed or planted vegetation, you must provide established uniform vegetation (e.g., evenly distributed without large bare areas), which provides 70 percent or more of the density of coverage that was provided by vegetation prior to commencing earth-disturbing activities. You should avoid the use of invasive species;
 - ii. For final stabilization, vegetative cover must be perennial; and
 - iii. Immediately after seeding or planting the area to be vegetatively stabilized, to the extent necessary to prevent erosion on the seeded or planted area, you must select, design, and install non-vegetative erosion controls that provide cover (e.g., mulch, rolled erosion control products) to the area while vegetation is becoming established.
- b. For sites located in arid or semi-arid areas, or drought-stricken areas. If you are located in an arid or semi-arid area, or a drought-stricken area, as these terms are defined in Appendix A, you are considered to have completed final stabilization if both of the following criteria are met:
 - The area you have seeded or planted must within 3 years provide established vegetation that covers 70 percent or more of the density of vegetation prior to commencing earth-disturbing activities; and
 - ii. In addition to seeding or planting the area to be vegetatively stabilized, to the extent necessary to prevent erosion on the seeded or planted area, you must select, design, and install non-vegetative erosion controls that provide cover for at least 3 years without active maintenance by you.
- c. For sites located on land used for agriculture. Disturbed areas on land used for agricultural purposes (e.g., pipelines across crop or range land, staging areas for highway construction) that are restored to their preconstruction agricultural use are not subject to these final stabilization criteria. Areas disturbed that were not previously used for agricultural activities, and areas that are not being returned to preconstruction agricultural use, must meet the conditions for stabilization in this Part.

2.2.2.2 Non-Vegetative Stabilization. If you are using non-vegetative controls to stabilize exposed portions of your site, or if you are using such controls to temporarily protect areas that are being vegetatively stabilized, you must provide effective non-vegetative cover¹⁵ to stabilize any such exposed portions of your site.

2.3. POLLUTION PREVENTION REQUIREMENTS.

You are required to design, install, and maintain effective pollution prevention measures in order to prevent the discharge of pollutants. Consistent with this requirement, you must:

- Eliminate certain pollutant discharges from your site (see Part 2.3.1);
- Properly maintain all pollution prevention controls (see Part 2.3.2); and
- Comply with pollution prevention standards for pollutant-generating activities that occur at your site (see Part 2.3.3).

These requirements apply to all areas of your construction site and any and all support activities covered by this permit consistent with Part 1.3.c.

2.3.1. Prohibited Discharges.

You are prohibited from discharging the following from your construction site:

- 2.3.1.1 Wastewater from washout of concrete, unless managed by an appropriate control as described in Part 2.3.3.4;
- 2.3.1.2 Wastewater from washout and cleanout of stucco, paint, form release oils, curing compounds and other construction materials, unless managed by an appropriate control as described in Part 2.3.3.4;
- 2.3.1.3 Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance;
- 2.3.1.4 Soaps, solvents, or detergents used in vehicle and equipment washing; and
- 2.3.1.5 Toxic or hazardous substances from a spill or other release.

2.3.2. General Maintenance Requirements.

You must ensure that all pollution prevention controls installed in accordance with this Part remain in effective operating condition and are protected from activities that would reduce their effectiveness. You must inspect all pollutant-generating activities and pollution prevention controls in accordance with your inspection frequency requirements in Parts 4.1.2 or 3.2.2.1 to avoid situations that may result in leaks, spills, and other releases of pollutants in stormwater discharges to receiving waters, and must document your findings in accordance with Part 4.1.7. If you find that controls need to be replaced, repaired, or maintained, you must make the necessary repairs or modifications in accordance with the following:

2.3.2.1 Initiate work to fix the problem immediately after discovering the problem, and complete such work by the close of the next work day, if the problem does not require significant repair or replacement, or if the problem can be corrected through routine maintenance.

¹⁵ For temporary stabilization, examples of temporary non-vegetative stabilization methods include, but are not limited to, hydromulch and erosion control blankets. For final stabilization, examples of permanent non-vegetative stabilization methods include, but are not limited to, riprap, gabions, and geotextiles.

2.3.2.2 When installation of a new pollution prevention control or a significant repair is needed, you must install the new or modified control and make it operational, or complete the repair, by no later than 7 calendar days from the time of discovery. If it is infeasible to complete the installation or repair within 7 calendar days, you must document in your records why it is infeasible to complete the installation or repair within the 7 calendar day timeframe and document your schedule for installing the stormwater control(s) and making it operational as soon as practicable after the 7 calendar day timeframe. Where these actions result in changes to any of the pollution prevention controls or procedures documented in your SWPPP, you must modify your SWPPP accordingly within 7 calendar days of completing this work.

2.3.3. Pollution Prevention Standards.

You are required to comply with the pollution prevention standards in this Part if you conduct any of the following activities at your site or at any construction support activity areas covered by this permit (see Part 1.3.c):

- · Fueling and maintenance of equipment or vehicles;
- Washing of equipment and vehicles;
- Storage, handling, and disposal of construction materials, products, and wastes; and
- Washing of applicators and containers used for paint, concrete, or other materials.

The pollution prevention standards are as follows:

2.3.3.1 Fueling and Maintenance of Equipment or Vehicles. If you conduct fueling and/or maintenance of equipment or vehicles at your site, you must provide an effective means of eliminating the discharge of spilled or leaked chemicals, including fuel, from the area where these activities will take place.¹⁶

To comply with the prohibition in Part 2.3.1.3, you must:

- a. If applicable, comply with the Spill Prevention Control and Countermeasures (SPCC) requirements in 40 CFR 112 and Section 311 of the CWA;
- Ensure adequate supplies are available at all times to handle spills, leaks, and disposal of used liquids;
- c. Use drip pans and absorbents under or around leaky vehicles;
- Dispose of or recycle oil and oily wastes in accordance with other federal, state, tribal, or local requirements;
- Clean up spills or contaminated surfaces immediately, using dry clean up measures where possible, and eliminate the source of the spill to prevent a discharge or a furtherance of an ongoing discharge; and
- Do not clean surfaces by hosing the area down.

¹⁶ Examples of effective controls include, but are not limited to, locating activities away from surface waters and stormwater inlets or conveyances, providing secondary containment (e.g., spill berms, decks, spill containment pallets) and cover where appropriate, and/or having spill kits readily available.

2.3.3.2 Washing of Equipment and Vehicles.

- You must provide an effective means of minimizing the discharge of pollutants from equipment and vehicle washing, wheel wash water, and other types of washing;¹⁷ and
- b. To comply with the prohibition in Part 2.3.1.4, for storage of soaps, detergents, or solvents, you must provide either (1) cover (e.g., plastic sheeting or temporary roofs) to prevent these detergents from coming into contact with rainwater, or (2) a similarly effective means designed to prevent the discharge of pollutants from these areas.
- 2.3.3.3 Storage, Handling, and Disposal of Construction Products, Materials, and Wastes. You must minimize the exposure to stormwater of any of the products, materials, or wastes specified below that are present at your site by complying with the requirements in this Part.

Note: These requirements do not apply to those products, materials, or wastes that are not a source of stormwater contamination or that are designed to be exposed to stormwater.

To ensure you meet this requirement, you must:

- a. For building products¹⁸: In storage areas, provide either (1) cover (e.g., plastic sheeting or temporary roofs) to prevent these products from coming into contact with rainwater, or (2) a similarly effective means designed to prevent the discharge of pollutants from these areas.
- For pesticides, herbicides, insecticides, fertilizers, and landscape materials:
 - In storage areas, provide either (1) cover (e.g., plastic sheeting or temporary roofs) to prevent these chemicals from coming into contact with rainwater, or (2) a similarly effective means designed to prevent the discharge of pollutants from these areas; and
 - Comply with all application and disposal requirements included on the registered pesticide, herbicide, insecticide, and fertilizer label.
- For diesel fuel, oil, hydraulic fluids, other petroleum products, and other chemicals:
 - i. To comply with the prohibition in Part 2.3.1.3, store chemicals in water-tight containers, and provide either (1) cover (e.g., plastic sheeting or temporary roofs) to prevent these containers from coming into contact with rainwater, or (2) a similarly effective means designed to prevent the discharge of pollutants from these areas (e.g., spill kits), or provide secondary containment (e.g., spill berms, decks, spill containment pallets); and
 - ii. Clean up spills immediately, using dry clean-up methods where possible, and dispose of used materials properly. Do not clean

¹⁷ Examples of effective controls include, but are not limited to, locating activities away from surface waters and stormwater inlets or conveyances and directing wash waters to a sediment basin or sediment trap, using filtration devices, such as filter bags or sand filters, or using other similarly effective controls.

¹⁸ Some examples of building products that are typically stored at construction sites include, but are not limited to, asphalt sealants, copper flashing, roofing materials, adhesives, concrete admixtures.

surfaces or spills by hosing the area down. Eliminate the source of the spill to prevent a discharge or a continuation of an ongoing discharge.

- d. For hazardous or toxic waste¹⁹:
 - Separate hazardous or toxic waste from construction and domestic waste;
 - ii. Store waste in sealed containers, which are constructed of suitable materials to prevent leakage and corrosion, and which are labeled in accordance with applicable Resource Conservation and Recovery Act (RCRA) requirements and all other applicable federal, state, tribal, or local requirements;
 - iii. Store all containers that will be stored outside within appropriatelysized secondary containment (e.g., spill berms, decks, spill containment pallets) to prevent spills from being discharged, or provide a similarly effective means designed to prevent the discharge of pollutants from these areas (e.g., storing chemicals in covered area or having a spill kit available on site);
 - iv. Dispose of hazardous or toxic waste in accordance with the manufacturer's recommended method of disposal and in compliance with federal, state, tribal, and local requirements; and
 - v. Clean up spills immediately, using dry clean-up methods where possible, and dispose of used materials properly. Do not clean surfaces or spills by hosing the area down. Eliminate the source of the spill to prevent a discharge or a furtherance of an ongoing discharge.
- e. For construction and domestic waste²⁰: Provide waste containers (e.g., dumpster or trash receptacle) of sufficient size and number to contain construction and domestic wastes. In addition, you must:
 - (1) On work days, clean up and dispose of waste in designated waste containers; and
 - (2) Clean up immediately if containers overflow.
- For sanitary waste: Position portable toilets so that they are secure and will not be tipped or knocked over.
- 2.3.3.4 Washing of Applicators and Containers used for Paint, Concrete, or Other Materials. To comply with the prohibition in Parts 2.3.1.1 and 2.3.1.2, you must provide an effective means of eliminating the discharge of water from the washout and cleanout of stucco, paint, concrete, form release oils, curing compounds, and other construction materials. To comply with this requirement, you must:

¹⁹ Examples of hazardous or toxic waste that may be present at construction sites include, but are not limited to, paints, solvents, petroleum-based products, wood preservatives, additives, curing compounds, acids.

Examples of construction and domestic waste include, but are not limited to, packaging materials, scrap construction materials, masonry products, timber, pipe and electrical cuttings, plastics, styrofoam, concrete, and other trash or building materials.

- Direct all washwater into a leak-proof container or leak-proof pit. The container or pit must be designed so that no overflows can occur due to inadequate sizing or precipitation;
- b. Handle washout or cleanout wastes as follows:
 - Do not dump liquid wastes in storm sewers;
 - Dispose of liquid wastes in accordance with applicable requirements in Part 2.3.3.3; and
 - iii. Remove and dispose of hardened concrete waste consistent with your handling of other construction wastes in Part 2.3.3.3; and
- c. Locate any washout or cleanout activities as far away as possible from surface waters and stormwater inlets or conveyances, and, to the extent practicable, designate areas to be used for these activities and conduct such activities only in these areas.

2.3.4. Emergency Spill Notification.

You are prohibited from discharging toxic or hazardous substances from a spill or other release, consistent with Part 2.3.1.5. Where a leak, spill, or other release containing a hazardous substance or oil in an amount equal to or in excess of a reportable quantity established under either 40 CFR Part 110, 40 CFR Part 117, or 40 CFR Part 302 occurs during a 24-hour period, you must notify the National Response Center (NRC) at (800) 424-8802 or, in the Washington, DC metropolitan area, call (202) 267-2675 in accordance with the requirements of 40 CFR Part 110, 40 CFR Part 117, and 40 CFR Part 302 as soon as you have knowledge of the discharge. You must also, within 7 calendar days of knowledge of the release, provide a description of the release, the circumstances leading to the release, and the date of the release. State, tribal, or local requirements may necessitate additional reporting of spills or discharges to local emergency response, public health, or drinking water supply agencies.

2.3.5. Fertilizer Discharge Restrictions.

You are required to minimize discharges of fertilizers containing nitrogen or phosphorus. To meet this requirement, you must comply with the following requirements:

- 2.3.5.1 Apply at a rate and in amounts consistent with manufacturer's specifications, or document departures from the manufacturer specifications where appropriate in Part 7.2.7.3 of the SWPPP;
- 2.3.5.2 Apply at the appropriate time of year for your location, and preferably timed to coincide as closely as possible to the period of maximum vegetation uptake and growth;
- 2.3.5.3 Avoid applying before heavy rains that could cause excess nutrients to be discharged;
- 2.3.5.4 Never apply to frozen ground;
- 2.3.5.5 Never apply to stormwater conveyance channels with flowing water; and
- 2.3.5.6 Follow all other federal, state, tribal, and local requirements regarding fertilizer application.

WATER QUALITY-BASED EFFLUENT LIMITATIONS.

3.1. GENERAL EFFLUENT LIMITATION TO MEET APPLICABLE WATER QUALITY STANDARDS

Your discharge must be controlled as necessary to meet applicable water quality standards. You must also comply with any additional requirements that your state or tribe requires you to meet in Part 9.

In the absence of information demonstrating otherwise, EPA expects that compliance with the conditions in this permit will result in stormwater discharges being controlled as necessary to meet applicable water quality standards. If at any time you become aware, or EPA determines, that your discharge is not being controlled as necessary to meet applicable water quality standards, you must take corrective action as required in Part 5.2.1, and document the corrective actions as required in Part 5.2.2 and Part 5.4.

EPA will also impose additional water quality-based limitations on a site-specific basis, or require you to obtain coverage under an individual permit, if information in your NOI, or from other sources indicates that your discharges are not controlled as necessary to meet applicable water quality standards. This includes situations where additional controls are necessary to comply with a wasteload allocation in an EPA established or approved TMDL.

3.2. DISCHARGE LIMITATIONS FOR IMPAIRED WATERS

If you discharge to a surface water that is impaired for (1) sediment or a sediment-related parameter, such as total suspended solids (TSS) or turbidity, and/or (2) nutrients, including impairments for nitrogen and/or phosphorus, you are required to comply with the requirements in Part 3.2.2.

Note: For the purposes of this Part, "impaired waters" are waters identified as impaired on the appropriate CWA Section 303(d) list, or waters with an EPA-approved or established TMDL. Your construction site will be considered to discharge to an impaired water if the first surface water to which you discharge is identified by a state, tribe, or EPA pursuant to Section 303(d) of the CWA as not meeting an applicable water quality standard, or is included in an EPA-approved or established total maximum daily load (TMDL). For discharges that enter a storm sewer system prior to discharge, the first surface water to which you discharge is the waterbody that receives the stormwater discharge from the storm sewer system.

If you discharge to an impaired water that is impaired for a parameter other than a sediment-related parameter or nutrients, EPA will inform you if any additional limits or controls are necessary for your discharge to be controlled as necessary to meet water quality standards, including for it to be consistent with the assumptions of any available wasteload allocation in any applicable TMDL, or if coverage under an individual permit is necessary in accordance with Part 1.4.5.

If during your coverage under a previous permit, you were required to install and maintain stormwater controls specifically to meet the assumptions and requirements of an EPA-approved or established TMDL (for any parameter) or to otherwise control your discharge to meet water quality standards, you must continue to implement such controls as part of this permit.

3.2.1. Identify If You Discharge To An Impaired Water.

If you discharge to an impaired water, you must provide the following information in your NOI:

- A list of all impaired waters to which you discharge;
- The pollutant(s) for which the surface water is impaired; and

 Whether a TMDL has been approved or established for the waters to which you discharge.

3.2.2. Requirements for Discharges to Sediment or Nutrient-Impaired Waters.

If you discharge to a surface water that is impaired for (1) sediment or a sediment-related parameter (e.g., total suspended solids (TSS) or turbidity) and/or (2) nutrients (e.g., nitrogen and/or phosphorus), including impaired waters for which a TMDL has been approved or established for the impairment, you are required to comply with the following stormwater control requirements, which supplement the requirements applicable to your site in other corresponding parts of the permit

- 3.2.2.1 Frequency of Site Inspection. You must conduct inspections at the frequency specified in Part 4.1.3.
- 3.2.2.2 Deadline to Complete Stabilization. You must comply with the deadlines for completing site stabilization as specified in Part 2.2.1.3c.
- 3.2.2.3 State and Tribal Requirements. You must comply with any additional state or tribal impairment-related requirements included in Part 9.

EPA will also impose additional water quality-based limitations on a site-specific basis, or require you to obtain coverage under an individual permit, if it is determined that the controls in the Part will not be sufficient to control discharges consistent with the assumptions and requirements of an applicable wasteload allocation of an approved or established TMDL or to prevent the site from contributing to the impairment.

- 3.3. DISCHARGES TO WATERS IDENTIFIED AS TIER 2, TIER 2.5, OR TIER 3.
- 3.3.1. Identify if You Discharge to a Tier 2, Tier 2.5, or Tier 3 Water.

If you discharge to a water identified by a state, tribe, or EPA as Tier 2, Tier 2.5, or Tier 3 water, you must provide on your NOI a list of waters identified as Tier 2, Tier 2.5, or Tier 3 to which you discharge. See Appendix F for a list of Tier 2 and 3 waters in Idaho, Massachusetts, New Hampshire, and New Mexico.

Note: For the purposes of this permit, you are considered to discharge to a Tier 2. Tier 2.5, or Tier 3 water if the first surface water to which you discharge is identified by a state, tribe, or EPA as Tier 2, Tier 2.5, or Tier 3. Tiers 2, 2.5 and 3 refer to waters either identified by the state as high quality waters or Outstanding National Resource Waters under 40 CFR §131.12(a)(2) and (3). For discharges that enter a storm sewer system prior to discharge, the surface water to which you discharge is the first surface water that receives the stormwater discharge from the storm sewer system.

3.3.2. Requirements for New Projects Discharging to Tier 2, Tier 2.5, or Tier 3 Waters.

For new projects, if you will discharge to a Tier 2, Tier 2.5, or Tier 3 water, you are required to comply with the requirements in Parts 4.1.3 (inspection frequencies) and 2.2.1.3c (stabilization deadlines), and, if applicable, Part 9 (relevant state or tribal requirements). In addition, on a case-by-case basis, EPA may notify operators of such new projects or operators of existing projects with increased discharges that additional analyses, stormwater controls, or other permit conditions are necessary to comply with the applicable antidegradation requirements, or notify you that an individual permit application is necessary in accordance with Part 1.4.5.

- INSPECTIONS.
- 4.1. SITE INSPECTIONS.
- 4.1.1. Person(s) Responsible for Inspecting Site.

The person(s) inspecting your site may be a person on your staff or a third party you hire to conduct such inspections. You are responsible for ensuring that the person who conducts inspections is a "qualified person."

Note: A "qualified person" is a person knowledgeable in the principles and practice of erosion and sediment controls and pollution prevention, who possesses the skills to assess conditions at the construction site that could impact stormwater quality, and the skills to assess the effectiveness of any stormwater controls selected and installed to meet the requirements of this permit.

4.1.2. Frequency of Inspections.

At a minimum, you must conduct a site inspection in accordance with one of the two schedules listed below, unless you are subject to Part 4.1.3 or Part 4.1.4:

- 4.1.2.1 At least once every 7 calendar days; or
- 4.1.2.2 Once every 14 calendar days and within 24 hours of the occurrence of a storm event of 0.25 inches or greater. To determine if a storm event of 0.25 inches or greater has occurred on your site, you must either keep a properly maintained rain gauge on your site, or obtain the storm event information from a weather station that is representative of your location. For any day of rainfall during normal business hours that measures 0.25 inches or greater, you must record the total rainfall measured for that day in accordance with Part 4.1.7.1d.

Note: Inspections are only required during the project's normal working hours.

Note: You are required to specify in your SWPPP which schedule you will be following.

Note: "Within 24 hours of the occurrence of a storm event" means that you are required to conduct an inspection within 24 hours once a storm event has produced 0.25 inches, even if the storm event is still continuing. Thus, if you have elected to inspect bi-weekly in accordance with Part 4.1.2.2 and there is a storm event at your site that continues for multiple days, and each day of the storm produces 0.25 inches or more of rain, you are required to conduct an inspection within 24 hours of the first day of the storm and within 24 hours after the end of the storm.

4.1.3. Increase in Inspection Frequency for Sites Discharging to Sensitive Waters.

For any portion of the site that discharges to a sediment or nutrient-impaired water (see Part 3.2) or to a water that is identified by your state, tribe, or EPA as Tier 2, Tier 2.5, or Tier 3 for antidegradation purposes (see Part 3.3), instead of the inspection frequency specified in Part 4.1.2, you must conduct inspections in accordance with the following inspection frequencies:

- 4.1.3.1 Once every 7 calendar days; and
- 4.1.3.2 Within 24 hours of the occurrence of a storm event of 0.25 inches or greater. To determine if a storm event of 0.25 inches or greater has occurred on your site, you must either keep a properly maintained rain gauge on your site, or obtain the storm event information from a weather station that is representative of your location. For any day of rainfall during normal business hours that

measures 0.25 inches or greater, you must record the total rainfall measured for that day in accordance with Part 4.1.7.1d.

Note: Inspections are only required during the project's normal working hours.

Note: "Within 24 hours of the occurrence of a storm event" means that you are required to conduct an inspection within 24 hours once a storm event has produced 0.25 inches, even if the storm event is still continuing. Thus, if there is a storm event at your site that continues for multiple days, and each day of the storm produces 0.25 inches or more of rain, you are required to conduct an inspection within 24 hours of the first day of the storm and within 24 hours after the end of the storm.

Note: If you qualify for any of the reduced inspection frequencies in Part 4.1.4, you may conduct inspections in accordance with Part 4.1.4 for any portion of your site that discharges to a sensitive water.

4.1.4. Reductions in Inspection Frequency.

Your inspection frequency may be reduced as follows:

- 4.1.4.1 For Stabilized Areas. You may reduce the frequency of inspections to once per month in any area of your site where the stabilization steps in Parts 2.2.1.2a and 2.2.1.2b have been completed. If construction activity resumes in this portion of the site at a later date, the inspection frequency immediately increases to that required in Parts 4.1.2 or 4.1.3, if applicable. You must document the beginning and ending dates of this period in your records.
- 4.1.4.2 For Arid, Semi-Arid, or Drought-Stricken Areas. You may reduce the frequency of inspections to once per month and within 24 hours of the occurrence of a storm event of 0.25 inches or greater if your site is located in an arid, semi-arid, or drought-stricken area, as these terms are defined in Appendix A, and construction is occurring during the seasonally dry period or during a period in which drought is predicted to occur. You must document that you are using this reduced schedule and the beginning and ending dates of the seasonally dry period in your SWPPP. To determine if a storm event of 0.25 inches or greater has occurred on your site, you must either keep a properly maintained rain gauge on your site, or obtain the storm event information from a weather station that is representative of your location. For any day of rainfall during normal business hours that measures 0.25 inches or greater, you must record the total rainfall measured for that day in accordance with Part 4.1.7.1d.

Note: Inspections are only required during the project's normal working hours.

Note: "Within 24 hours of the occurrence of a storm event" means that you are required to conduct an inspection within 24 hours once a storm event has produced 0.25 inches, even if the storm event is still continuing. Thus, if there is a storm event at your site that continues for multiple days, and each day of the storm produces 0.25 inches or more of rain, you are required to conduct an inspection within 24 hours of the first day of the storm and within 24 hours after the end of the storm.

4.1.4.3 For Frozen Conditions.

 If you are suspending earth-disturbing activities due to frozen conditions, you may temporarily suspend inspections on your site until thawing conditions (see Appendix A) begin to occur if:

- i. Runoff is unlikely due to continuous frozen conditions that are likely to continue at your site for at least 3 months based on historic seasonal averages. If unexpected weather conditions (such as above freezing temperatures or rain on snow events) make discharges likely, you must immediately resume your regular inspection frequency as described in Parts 4.1.2 or 4.1.3, if applicable;
- ii. Land disturbances have been suspended; and
- All disturbed areas of the site have been temporarily or permanently stabilized in accordance with Part 2.2.
- If you are still conducting earth-disturbing activities during frozen conditions, you may reduce your inspection frequency to once per month if:
 - i. Runoff is unlikely due to continuous frozen conditions that are likely to continue at your site for at least 3 months based on historic seasonal averages. If unexpected weather conditions (such as above freezing temperatures or rain on snow events) make discharges likely, you must immediately resume your regular inspection frequency as described in Parts 4.1.2 or 4.1.3 if applicable; and
 - ii. Except for areas in which you are actively conducting earthdisturbing activities, disturbed areas of the site have been temporarily or permanently stabilized in accordance with Part 2.2.

You must document the beginning and ending dates of this period in your SWPPP.

- 4.1.5. Areas that Need to Be Inspected. During your site inspection, you must at a minimum inspect the following areas of your site:
 - 4.1.5.1 All areas that have been cleared, graded, or excavated and that have not yet completed stabilization consistent with Part 2.2;
 - 4.1.5.2 All stormwater controls (including pollution prevention measures) installed at the site to comply with this permit;
 - 4.1.5.3 Material, waste, borrow, or equipment storage and maintenance areas that are covered by this permit;
 - 4.1.5.4 All areas where stormwater typically flows within the site, including drainageways designed to divert, convey, and/or treat stormwater;
 - 4.1.5.5 All points of discharge from the site; and
 - 4.1.5.6 All locations where stabilization measures have been implemented.

You are not required to inspect areas that, at the time of the inspection, are considered unsafe to your inspection personnel.

- 4.1.6. Requirements for Inspections. During your site inspection, you must at a minimum:
 - 4.1.6.1 Check whether all erosion and sediment controls and pollution prevention controls are installed, appear to be operational, and are working as intended to minimize pollutant discharges. Determine if any controls need to be replaced, repaired, or maintained in accordance with Parts 2.1.1.4 and 2.3.2;

- 4.1.6.2 Check for the presence of conditions that could lead to spills, leaks, or other accumulations of pollutants on the site;
- 4.1.6.3 Identify any locations where new or modified stormwater controls are necessary to meet the requirements of Parts 2 and/or 3;
- 4.1.6.4 At points of discharge and, if applicable, the banks of any surface waters flowing within your property boundaries or immediately adjacent to your property, check for signs of visible erosion and sedimentation (i.e., sediment deposits) that have occurred and are attributable to your discharge; and
- 4.1.6.5 Identify any and all incidents of noncompliance observed.
- 4.1.6.6 If a discharge is occurring during your inspection, you are required to:
 - a. Identify all points of the property from which there is a discharge;
 - Observe and document the visual quality of the discharge, and take note of the characteristics of the stormwater discharge, including color, odor, floating, settled, or suspended solids, foam, oil sheen, and other obvious indicators of stormwater pollutants; and
 - Document whether your stormwater controls are operating effectively, and describe any such controls that are clearly not operating as intended or are in need of maintenance.
- 4.1.6.7 Based on the results of your inspection, initiate corrective action under Part 5.

4.1.7. Inspection Report.

- 4.1.7.1 Requirement to Complete Inspection Report. You must complete an inspection report within 24 hours of completing any site inspection. Each inspection report must include the following:
 - a. The inspection date;
 - b. Names and titles of personnel making the inspection;
 - A summary of your inspection findings, covering at a minimum the observations you made in accordance with Part 4.1.6;
 - d. If you are inspecting your site at the frequency specified in Part 4.1.2.2, Part 4.1.3, or Part 4.1.4.2, and you conducted an inspection because of rainfall measuring 0.25 inches or greater, you must include the applicable rain gauge or weather station readings that triggered the inspection; and
 - If you have determined that it is unsafe to inspect a portion of your site, you must describe the reason you found it to be unsafe and specify the locations that this condition applied to.
- 4.1.7.2 Signature Requirements. Each inspection report must be signed in accordance with Appendix I, Part I.11 of this permit.
- 4.1.7.3 Recordkeeping Requirements. You are required to keep a current, copy of all inspection reports at the site or at an easily accessible location, so that it can be made available at the time of an onsite inspection or upon request by EPA. For purposes of this permit, your inspection reports may be kept electronically if the records are:
 - a. In a format that can be read in a similar manner as a paper record;

- Legally dependable with no less evidentiary value than their paper equivalent; and
- Accessible to the inspector during an inspection to the same extent as a paper copy stored at the site would be, if the records were stored in paper form.

Note: See Section IX.1.7 of the Fact Sheet for a discussion on ways to ensure that electronic records satisfy this requirement. See Appendix I, Part I.11.5 for requirements relating to electronic signature of these documents.

All inspection reports completed for this Part must be retained for at least 3 years from the date that your permit coverage expires or is terminated.

4.2. INSPECTIONS BY EPA.

You must allow EPA, or an authorized representative of the EPA, to conduct the following activities at reasonable times:

- 4.2.1. Enter onto areas of your site, including any construction support activity areas covered by this permit (see Part 1.3.c), and onto locations where records are kept under the conditions of this permit;
- 4.2.2. Access and copy any records that must be kept under the conditions of this permit;
- 4.2.3. Inspect your construction site, including any construction support activity areas covered by this permit (see Part 1.3.c) and any stormwater controls installed and maintained at the site; and
- 4.2.4. Sample or monitor for the purpose of ensuring compliance.

5. CORRECTIVE ACTIONS.

5.1. "CORRECTIVE ACTIONS" DEFINED.

Corrective actions are actions you take in compliance with this Part to:

- Repair, modify, or replace any stormwater control used at the site;
- Clean up and properly dispose of spills, releases, or other deposits; or
- Remedy a permit violation.

5.2. REQUIREMENTS FOR TAKING CORRECTIVE ACTION.

You must complete the following corrective actions in accordance with the deadlines specified in this Part. In all circumstances, you must immediately take all reasonable steps to minimize or prevent the discharge of pollutants until a permanent solution is installed and made operational, including cleaning up any contaminated surfaces so that the material will not discharge in subsequent storm events.

Note: In this context, the term "immediately" requires construction operators to, on the same day a condition requiring corrective action is found, take all reasonable steps to minimize or prevent the discharge of pollutants until a permanent solution is installed and made operational. However, if the problem is identified at a time in the work day when it is too late to initiative corrective action, the initiation of corrective action must begin on the following work day.

- 5.2.1. For any of the following conditions on your site, you must install a new or modified control and make it operational, or complete the repair, by no later than 7 calendar days from the time of discovery. If it is infeasible to complete the installation or repair within 7 calendar days, you must document in your records why it is infeasible to complete the installation or repair within the 7 calendar day timeframe and document your schedule for installing the stormwater control(s) and making it operational as soon as practicable after the 7-day timeframe.
 - 5.2.1.1 A required stormwater control was never installed, was installed incorrectly, or not in accordance with the requirements in Parts 2 and/or 3; or
 - 5.2.1.2 You become aware that the stormwater controls you have installed and are maintaining are not effective enough for the discharge to meet applicable water quality standards or applicable requirements in Part 3.1. In this case, you must notify your EPA Regional Office by the end of the next work day. You are required to submit your notification through EPA's electronic NOI system, or "eNOI", at www.epa.gov/npdes/capenoi; or
 - 5.2.1.3 One of the prohibited discharges in Part 2.3.1 is occurring or has occurred.
- 5.2.2. Where your corrective actions result in changes to any of the stormwater controls or procedures documented in your SWPPP, you must modify your SWPPP accordingly within 7 calendar days of completing corrective action work.

5.3. CORRECTIVE ACTION REQUIRED BY EPA.

You must comply with any corrective actions required by EPA as a result of permit violations found during an inspection carried out under Part 4.2.

5.4. CORRECTIVE ACTION REPORT.

For each corrective action taken in accordance with this Part, you must complete a corrective action report, which includes the applicable information in Parts 5.4.1 and 5.4.2. Note that these reports must be maintained in your records but do not need to be provided to EPA except upon request.

- 5.4.1. Within 24 hours of discovering the occurrence of one of the triggering conditions in Part 5.2.1 at your site, you must complete a report of the following:
 - 5.4.1.1 Which condition was identified at your site;
 - 5.4.1.2 The nature of the condition identified; and
 - 5.4.1.3 The date and time of the condition identified and how it was identified.
- 5.4.2. Within 7 calendar days of discovering the occurrence of one of the triggering conditions in Part 5.2.1 at your site, you must complete a report of the following:
 - 5.4.2.1 Any follow-up actions taken to review the design, installation, and maintenance of stormwater controls, including the dates such actions occurred;
 - 5.4.2.2 A summary of stormwater control modifications taken or to be taken, including a schedule of activities necessary to implement changes, and the date the modifications are completed or expected to be completed; and
 - 5.4.2.3 Notice of whether SWPPP modifications are required as a result of the condition identified or corrective action.
- 5.4.3. Signature Requirements. Each corrective action report must be signed and certified in accordance with Appendix I, Part I.11 of this permit.
- 5.4.4. Recordkeeping Requirements. You are required to keep a current copy of all corrective action reports at the site or at an easily accessible location, so that it can be made available at the time of an onsite inspection or upon request by EPA. For purposes of this permit, your corrective action reports may be kept electronically if the records are:
 - 5.4.4.1 In a format that can be read in a similar manner as a paper record;
 - 5.4.4.2 Legally dependable with no less evidentiary value than their paper equivalent; and
 - 5.4.4.3 Accessible to the inspector during an inspection to the same extent as a paper copy stored at the site would be, if the records were stored in paper form.

Note: See Section IX.1.7 of the Fact Sheet for a discussion on ways to ensure that electronic records satisfy this requirement. See Appendix I, Part I.11.5 for requirements relating to electronic signature of these documents.

All corrective action reports completed for this Part must be retained for at least 3 years from the date that your permit coverage expires or is terminated.

STAFF TRAINING REQUIREMENTS.

Prior to the commencement of earth-disturbing activities or pollutant-generating activities, whichever occurs first, you must ensure that the following personnel understand the requirements of this permit and their specific responsibilities with respect to those requirements:

- Personnel who are responsible for the design, installation, maintenance, and/or repair of stormwater controls (including pollution prevention measures);
- Personnel responsible for the application and storage of treatment chemicals (if applicable);
- Personnel who are responsible for conducting inspections as required in Part 4.1.1;
 and
- Personnel who are responsible for taking corrective actions as required in Part 5.

Notes:

(1) If the person requiring training is a new employee, who starts after you commence earth-disturbing or pollutant-generating activities, you must ensure that this person has the proper understanding as required above prior to assuming particular responsibilities related to compliance with this permit.

(2) For emergency-related construction activities, the requirement to train personnel prior to commencement of earth-disturbing activities does not apply, however, such personnel must have the required training prior to NOI submission.

You are responsible for ensuring that all activities on the site comply with the requirements of this permit. You are not required to provide or document formal training for subcontractors or other outside service providers, but you must ensure that such personnel understand any requirements of the permit that may be affected by the work they are subcontracted to perform.

At a minimum, personnel must be trained to understand the following if related to the scope of their job duties (e.g., only personnel responsible for conducting inspections need to understand how to conduct inspections):

- The location of all stormwater controls on the site required by this permit, and how they are to be maintained;
- The proper procedures to follow with respect to the permit's pollution prevention requirements; and
- When and how to conduct inspections, record applicable findings, and take corrective actions.

7. STORMWATER POLLUTION PREVENTION PLAN (SWPPP).

7.1. GENERAL REQUIREMENTS.

7.1.1. Requirement to Develop a SWPPP Prior to Submitting Your NOI.

All operators associated with a construction project to be covered under this permit must develop a SWPPP.

Note: You have the option of developing a group SWPPP where you are one of several operators who will be engaged in construction activities at your site. For instance, if both the owner and the general contractor of the construction site are permitted, the owner may be the party responsible for SWPPP development, and the general contractor can choose to use this same SWPPP, as long as the SWPPP addresses the general contractor's scope of construction work and obligations under this permit.

You are required to develop your site's SWPPP prior to submitting your NOI. At a minimum, your SWPPP must include the information required in Part 7.2 and as specified in other parts of the permit. 21 You must also update the SWPPP as required in Part 7.4.

Note: If your project is an "existing project" (see Part 1.4.2.b) or if you are a new operator of an existing project" (see Part 1.4.2.c), and it is infeasible for you to comply with a specific requirement in this Part or in Parts 2.1, and 2.3.3 through 2.3.5 (except for Parts 2.3.3.1, 2.3.3.2b, 2.3.3.3c.i, and 2.3.3.4) because (1) the provision was not part of the permit you were previously covered under (i.e., the 2003 or 2008 CGP), and (2) because you are prevented from compliance due to the nature or location of earth disturbances that commenced prior to February 16, 2012, or because you are unable to comply with the requirement due to the manner in which stormwater controls have already been installed or were already designed prior to February 16, 2012, you are required to include documentation of the reasons why it is infeasible for you to meet the specific requirement, and then you may be waived from complying with this requirement. You must include a separate justification why it is infeasible for you to meet each of the applicable requirements.

If you prepared a SWPPP for coverage under a previous version of this NPDES permit, you must review and update your SWPPP to ensure that this permit's requirements are addressed prior to submitting your NOI.

7.2. SWPPP CONTENTS.

Your SWPPP must include the following information, at a minimum.

7.2.1. Stormwater Team.

Each operator, or group of multiple operators, must assemble a "stormwater team," which is responsible for overseeing the development of the SWPPP, any later modifications to it, and for compliance with the requirements in this permit.

The SWPPP must identify the personnel (by name or position) that are part of the stormwater team, as well as their individual responsibilities. Each member of the stormwater team must have ready access to an electronic or paper copy of applicable portions of this permit, the most updated copy of your SWPPP, and other relevant documents or information that must be kept with the SWPPP.

7.2.2. Nature of Construction Activities.

The SWPPP must describe the nature of your construction activities, including the size of the property (in acres) and the total area expected to be disturbed by the construction

²¹ The SWPPP does not establish the effluent limits that apply to your site's discharges; these limits are established in this permit in Parts 2 and 3.

activities (in acres), construction support activity areas covered by this permit (see Part 1.3.c), and the maximum area expected to be disturbed at any one time.

7.2.3. Emergency-Related Projects.

If you are conducting earth-disturbing activities in response to a public emergency (see Part 1.2), you must document the cause of the public emergency (e.g., natural disaster, extreme flooding conditions, etc.), information substantiating its occurrence (e.g., state disaster declaration or similar state or local declaration), and a description of the construction necessary to reestablish effected public services.

7.2.4. Identification of Other Site Operators.

The SWPPP must include a list of all other operators who will be engaged in construction activities at your site, and the areas of the site over which each operator has control.

7.2.5. Sequence and Estimated Dates of Construction Activities.

The SWPPP must include a description of the intended sequence of construction activities, including a schedule of the estimated start dates and the duration of the activity, for the following activities:

- 7.2.5.1 Installation of stormwater control measures, and when they will be made operational, including an explanation of how the sequence and schedule for installation of stormwater control measures complies with Part 2.1.1.3a and of any departures from manufacturer specifications pursuant to Part 2.1.1.3b;
- 7.2.5.2 Commencement and duration of earth-disturbing activities, including clearing and grubbing, mass grading, site preparation (i.e., excavating, cutting and filling), final grading, and creation of soil and vegetation stockpiles requiring stabilization;
- 7.2.5.3 Cessation, temporarily or permanently, of construction activities on the site, or in designated portions of the site;
- 7.2.5.4 Final or temporary stabilization of areas of exposed soil. The dates for stabilization must reflect the applicable deadlines to which you are subject in Part 2.2.1; and
- 7.2.5.5 Removal of temporary stormwater conveyances/channels and other stormwater control measures, removal of construction equipment and vehicles, and cessation of any pollutant-generating activities.
 - Note: If plans change due to unforeseen circumstances or for other reasons, the requirement to describe the sequence and estimated dates of construction activities is not meant to "lock in" the operator to meeting these projections. When departures from initial projections are necessary, this should be documented in the SWPPP itself or in associated records, as appropriate.

7.2.6. Site Map.

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The SWPPP must include a legible site map, or series of maps, showing the following features of your project:

- Note: Included in the project site are any construction support activities covered by this permit (see Part 1.3.c).
- 7.2.6.1 Boundaries of the property and of the locations where construction activities will occur, including:

- Locations where earth-disturbing activities will occur, noting any phasing of construction activities:
- Approximate slopes before and after major grading activities. Note areas of steep slopes, as defined in Appendix A;
- Locations where sediment, soil, or other construction materials will be stockpiled;
- d. Locations of any crossings of surface waters;
- Designated points on the site where vehicles will exit onto paved roads;
- Locations of structures and other impervious surfaces upon completion of construction; and
- Locations of construction support activity areas covered by this permit (see Part 1.3.c).
- 7.2.6.2 Locations of all surface waters, including wetlands, that exist within or in the immediate vicinity of the site. Indicate which waterbodies are listed as impaired, and which are identified by your state, tribe, or EPA as Tier 2, Tier 2.5, or Tier 3 waters;
- 7.2.6.3 The boundary lines of any natural buffers provided consistent with Part 2.1.2.1a;
- 7.2.6.4 Areas of federally-listed critical habitat for endangered or threatened species;
- 7.2.6.5 Topography of the site, existing vegetative cover (e.g., forest, pasture, pavement, structures), and drainage pattern(s) of stormwater and authorized non-stormwater flow onto, over, and from the site property before and after major grading activities;
- 7.2.6.6 Stormwater and allowable non-stormwater discharge locations, including:
 - Locations of any storm drain inlets on the site and in the immediate vicinity of the site; and
 - Note: The requirement to show storm drain inlets in the immediate vicinity of the site on your site map only applies to those inlets that are easily identifiable from your site or from a publicly accessible area immediately adjacent to your site.
 - Locations where stormwater or allowable non-stormwater will be discharged to surface waters (including wetlands) on or near the site.
- 7.2.6.7 Locations of all potential pollutant-generating activities identified in Part 7.2.7;
- 7.2.6.8 Locations of stormwater control measures; and
- 7.2.6.9 Locations where polymers, flocculants, or other treatment chemicals will be used and stored.

7.2.7. Construction Site Pollutants.

The SWPPP must include the following:

7.2.7.1 A list and description of all the pollutant-generating activities²² on your site.

Examples of pollutant-generating activities include, but are not limited to: paving operations; concrete, paint, and stucco washout and waste disposal; solid waste storage and disposal; and dewatering operations.

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Check Dams

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Minimum Measure: Construction Site Stormwater Runoff Control

Subcategory: Runoff Control

Description

Check dams are relatively small, temporary structures constructed across a swale or channel. They are used to slow the velocity of concentrated water flows, a practice that helps reduce erosion. As stormwater runoff flows through the structure, the check dam catches sediment from the channel itself or from the contributing drainage area. However, check dams should not be used as a substitute for other sediment-trapping and erosioncontrol measures. Check dams are typically constructed out of



Check dams are used to reduce the energy of stormwater to prevent erosion

gravel, rock, sandbags, logs or treated lumber, or straw bales. They are most effective when used with other stormwater, erosion, and sediment-control measures.

Applicability

Check dams are temporary measures used in swales or channels where it is impractical to implement other flow-control practices (such as lining the channel) (USEPA, 1993).

Check dams are effective in small channels with a contributing drainage area of two to 10 acres. Multiple check dams, spaced at appropriate intervals, can be effective. Dams used in a series should be spaced so that the base of the upstream dam is at the same elevation as the top of the next downstream dam (VDCR, 1995).

Siting and Design Considerations

Check dams can be made of a variety of materials. They are most commonly made of rock, logs, or sandbags. When using rock, the material diameter should be two to 15-inches. Logs should have a diameter of six to eight-inches. Regardless of the material used, build the check dam carefully to ensure its effectiveness. That is, do not simply dump the material into the channel. That would be inappropriate, and it might actually increase erosion.

A check dam should not be more than three-feet high, and the center of the dam should be at least six-inches lower than its edges. This design creates a weir effect that helps to channel flows away from the banks and prevent further erosion. Dams can be made more stable by implanting the material approximately six-inches into the sides and bottom of the channel (VDCR, 1995). When installing a series of check dams in a channel, install outlet stabilization measures below the final dam in the series. Because this area is likely to be vulnerable to further erosion, the use of other stabilization measures like riprap or geotextile lining is highly recommended.

Limitations

Do not build check dams in live, flowing streams unless approved by an appropriate regulatory agency (USEPA, 1992; VDCR, 1995). The primary function of check dams is to slow runoff in a channel. Do not use them as a standalone substitute for other sediment-trapping devices. Also, fallen leaves can clog check dams, so in the fall it may be necessary to increase inspections and maintenance.

Maintenance Considerations

Inspect check dams after each storm event to ensure their structural integrity. The center of a check dam should always be lower than its edges. Additional stone may have to be added to maintain the correct height. During inspection, remove large debris, trash, and leaves. When the sediment has reached a height of approximately one-half the original height of the dam (measured at the center), remove accumulated sediment from the upstream side of the dam. When check dams are removed, care must be taken to remove all dam materials to ensure proper flow within the channel. If erosion or heavy flows cause the edges of a dam to fall to a height equal to or below the height of the center, repair it immediately. In addition, before removing a check dam, remove all accumulated sediment. Remove a check dam only after the contributing drainage area has been completely stabilized. Use permanent vegetation to stabilize the area from which the dam material is removed.

Effectiveness

Field experience has shown that rock check dams are more effective than silt fences or straw bales to stabilize wet-weather ditches (VDCR, 1995). For long channels, check dams are most effective when used in a series, creating multiple barriers to sedimentladen runoff.

Cost Considerations

The cost of check dams varies according to the material they are made of and the width of the channel to be dammed. EPA (1992) estimated that check dams constructed of rock cost about \$100 per dam, although Brown and Schueler (CWP, 1997) estimated that rock check dams cost approximately \$62 per installation, including the cost for filter fabric bedding. Logs and sandbags may be less expensive alternatives to install, but their use may result in higher maintenance costs.

References

Brown and Schueler, 1997. The Economics of Stormwater BMPs in the Mid-Atlantic Region. Prepared for the Chesapeake Research Consortium. Edgewater, MD by the Center for Watershed protection, Ellicott City, MD.

USEPA (U.S. Environmental Protection Agency). 1992. Stormwater Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices. EPA 832-R-92-005. U.S. Environmental Protection Agency, Office of Water, Washington, DC.



Stormwater Best Management Practice

Concrete Washout



Minimum Measure

Construction Site Stormwater Runoff Control

Subcategory

Good Housekeeping/Materials Management

Description of Concrete Washout at Construction Sites

Concrete and its ingredients

Concrete is a mixture of cement, water, and aggregate material. Portland cement is made by heating a mixture of limestone and clay containing oxides of calcium, aluminum, silicon and other metals in a kiln and then pulverizing the resulting clinker. The fine aggregate particles are usually sand. Coarse aggregate is generally gravel or crushed stone. When cement is mixed with water, a chemical reaction called hydration occurs, which produces glue that binds the aggregates together to make concrete.

Concrete washout

After concrete is poured at a construction site, the chutes of ready mixed concrete trucks and hoppers of concrete pump trucks must be washed out to remove the remaining concrete before it hardens. Equipment such as wheelbarrows and hand tools also need to be washed down. At the end of each work day, the drums of concrete trucks must be washed out. This is customarily done at the ready mixed batch plants, which are usually off-site facilities, however large or rural construction projects may have on-site batch plants. Cementitious (having the properties of cement) washwater and solids also come from using such construction materials as mortar, plaster, stucco, and grout.

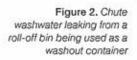
Environmental and Human Health Impacts

Concrete washout water (or washwater) is a slurry containing toxic metals. It's also caustic and corrosive, having a pH near 12. In comparison, Drano liquid drain cleaner has a pH of 13.5. Caustic washwater can harm fish gills and eyes and interfere with reproduction. The safe pH ranges for aquatic life nabitats are 6.5 – 9 for freshwater and 6.5 – 8.5 for saltwater.

Construction workers should handle wet concrete and washout water with care because it may cause skin irritation and eye damage. If the washwater is dumped on the ground (Fig. 1), it can run off the construction site to adjoining roads and enter roadside storm drains, which discharge to surface waters such as rivers, lakes, or estuaries. The red arrow in Figure 2 points to a ready mixed truck chute that's being washed out into a roll-off bin, which isn't watertight. Leaking washwater, shown in the foreground, will likely follow similar



Figure 1. Chute washwater being dumped on the ground



paths to nearby surface waters. Rainfall may cause concrete washout containers that are uncovered to overflow and also transport the washwater to surface waters. Rainwater polluted with concrete washwater can percolate down through the soil and alter the soil chemistry, inhibit plant growth, and contaminate the groundwater. Its high pH can increase the toxicity of other substances in the surface waters and soils. Figures 1 and 2 illustrate the need for better washout management practices.

Best Management Practice Objectives

The best management practice objectives for concrete washout are to (a) collect and retain all the concrete washout water and solids in leak proof containers, so that this caustic material does not reach the soil surface and then migrate to surface waters or into the ground water, and (b) recycle 100 percent of the collected concrete washout water and solids. Another

objective is to support the diversion of recyclable materials from andfills. Table 1 shows how concrete washout materials can be recycled and reused.

Table 1 – Recycling concrete washout materials

177.2		Concrete Washout Materials				
Uses of Recycled Materials	Washwater	Cement fines*	Fine aggregate	Coarse aggregate	Hardened concrete	Unused wet
Reused to washout additional mixer truck chutes or drums	х					
Reused as a ready mixed concrete ingredient	х	Χþ	х	х		H Je
Reused as an ingredient of precast concrete products, e.g., highway barriers, retaining wall blocks, riprap	x	x	x	x		х
Reused as crushed concrete products, e.g., road base or fill		х	x	х	х	
Reused to pave the yards of ready mixed concrete plants						х
Returned back to a surface water, e.g., river, lake, or estuary	Χc					

- a. Fine particles of cementitious material (e.g., Portland cement, slag cement, fly ash, silica fume)
- b. Recyclable, if allowed by the concrete quality specifications
- c. Treated to reduce the pH and remove metals, so it can be delivered to a municipal wastewater treatment plant, where it is treated further and then returned to a natural surface water

Washwater recycling, treatment, disposal

Washwater from concrete truck chutes, hand mixers, or other equipment can be passed through a system of weirs or filters to remove solids and then be reused to wash down more chutes and equipment at the construction site or as an ingredient for making additional concrete. A three chamber washout filter is shown in Figure 3. The first stage collects the coarse aggregate. The middle stage filters out the small grit and sand. The third stage has an array of tablets that filter



Figure 3. Concrete washout filter

out fines and reduces the pH. The filtered washwater is then discharged through a filter sock. An alternative is to pump the washout water out of the washout container (Fig 4) and treat the washwater off site to remove metals and reduce its pH, so it can be delivered to a publicly owned treatment works (POTW), also known as a municipal wastewater treatment plant, which provides additional treatment allowing the washwater to be discharged to a surface water. The POTW should be

contacted to inquire about any pretreatment requirements, i.e., the National Pretreatment Standards for Prohibited Dischargers (40CFR 403.5) before discharging the washwater to the POTW. The washwater can also be retained in the washout container and allowed to



Figure 4. Vacuuming washwater out of a washout container for treatment and reuse

evaporate, leaving only the hardened cementitious solids to be recycled.

Solids recycling

The course aggregate materials that are washed off concrete truck chutes into a washout container can be either separated by a screen and placed in aggregate bins to be reused at the construction site or returned to the ready mixed plant and washed into a reclaimer (Fig. 5). When washed out into a reclaimer, the fine and course aggregates are separated out and placed in different

piles or bins to be reused in making fresh concrete. Reclaimers with settling tanks separate cement fines from the washwater, and these fines can also be used in new concrete unless prohibited by the user's concrete quality specifications.



Figure 5. Ready mixed truck washing out into a reclaimer

Hardened concrete recycling

When the washwater in a construction site concrete washout container has been removed or allowed to evaporate, the hardened concrete that remains can be crushed (Fig. 6) and reused as a construction material. It makes an excellent aggregate for road base and can be used as fill at the



Figure 6. Crushed concrete stockpile and crusher

construction site or delivered to a recycler. Concrete recyclers can be found at municipal solid waste disposal facilities, private recycling plants, or large construction sites.

'Vet concrete recycling

Juilders often order a little more ready mixed concrete than they actually need, so it is common for concrete trucks to have wet concrete remaining in their drum after a delivery. This unused concrete can be returned to the ready mixed plant and either (1) used to pour precast concrete products (e.g., highway barriers, retaining wall blocks, riprap), (2) used to pave the ready mixed plant's yard, (3) washed into a reclaimer, or (4) dumped on an impervious surface and allowed to harden, so it can be crushed and recycled as aggregate. Unused wet concrete should not be dumped on bare ground to harden at construction sites because this can contribute to ground water and surface water contamination.

Washout Containers

Different types of washout containers are available for collecting, retaining, and recycling the washwater and solids from washing down mixed truck chutes and pump truck hoppers at construction sites.

Chute washout box

A chute washout box is mounted on the back of the ready nixed truck. If the truck has three chutes, the following procedure is used to perform the washout from the top down:

(1) after the pour is completed, the driver attaches the extension chute to the washout box, (2) the driver then rotates the main chute over the extension chute (Fig. 7) and washes down the hopper first then the main chute, (3) finally the driver washes down the flop down chute and last the extension chute hanging on the box. All washwater and solids are captured in the box.

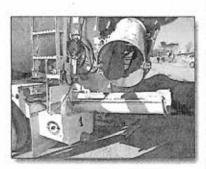


Figure 7. Chute washout box

After the wash down, washwater and solids are returned to the ready mixed plant for recycling. A filter basket near the top of the washout box separates out the coarse aggregates so they can be placed in a bin for reuse either at the construction site or back at the cement plant.

Chute washout bucket and pump

After delivering ready mixed concrete and scraping the last of the customer's concrete down the chute, the driver hangs a vashout bucket shown in Figure 8 (see red arrow) on the end of the truck's chute and secures the hose to insure no leaks. The driver then washes down the chute into the bucket to remove any cementitious material before it hardens. After washing out the chute, the driver pumps (yellow arrow points to the pump) the washwater, sand, and other fine solids from the bucket up into the truck's drum to be returned to the



Figure 8. Chute washout bucket and pump

ready mixed plant, where it can be washed into a reclaimer. A removable screen at the bottom of the washout bucket prevents course aggregate from entering the pump. This course aggregate can also be returned to the plant and added to the coarse aggregate pile to be reused. All the materials are recycled.

Hay bale and plastic washout pit

A washout pit made with hay bales and a plastic lining is shown in Figure 9. Such pits can be dug into the ground or built above grade. The plastic lining should be free of tears or holes that would allow the washwater to escape (Fig. 10). After the pit is used to wash down the chutes of multiple ready mixed trucks and the washwater has evaporated or has been vacuumed off, the remaining hardened solids can be broken up and removed from the pit. This process may damage the hay bales and plastic lining. If damage occurs, the pit will need to be repaired and relined with new plastic. When the hardened solids are removed, they may be bound up with the plastic lining and have to be sent to a landfill, rather than recycled. Recyclers usually accept only unmixed material. If the pit is going to be emptied and repaired more than a few times, the hay bales and plastic will be generating additional solid waste. Ready mixed concrete



Figure 9. Hay bale and plastic washout pit

Figure 10. Leaking washout pit that has not been well maintained

trucks can use hay bale washout pits, but concrete pump rucks have a low hanging hopper in the back that may prevent their being washed out into bale-lined pits.

Vinyl washout container



Figure 11. Vinyl washout pit with filter bag

The vinyl washout container (Fig. 11) is portable, reusable, and easier to install than a hay bale washout pit. The biodegradable filter bag (Fig. 12) assists in

extracting the concrete solids and prolongs the life of the vinyl container. When the bag is lifted, the water is filtered out and the remaining concrete solids and the bag can be disposed of together in a landfill, or the hardened concrete can be delivered to a recycler. After the solids have been removed several times and the container is full of washwater, the washwater can be allowed to evaporate, so the container can be reused. The washwater can be removed more quickly by placing another

filter bag in the container and spreading water gelling granules evenly across the vater. In about five minutes, the water in the filter bag will turn into a gel that can be removed with the bag. Then the gel and filter bag can be disposed to together.



Figure 12. Extracting the concrete solids or gelled washwater

Metal washout container

The metal roll-off bin (Fig. 13) is designed to securely contain concrete washwater and solids and is portable and reusable. It also has a ramp that allows concrete pump trucks to wash out their hoppers (Fig. 14). Roll-off providers offer recycling services, such as, picking up the roll-off bins after the washwater has evaporated and the solids have hardened,

replacing them with empty washout bins, and delivering the hardened concrete to a recycler (Fig. 15), rather than a landfill. Some providers will vacuum off the washwater. treat it to remove metals and reduce the pH, deliver it to a vastewater treatment plant for additional treatment and



Figure 13. Mixer truck being washed out into a roll-off bin

subsequent discharge to a surface water. Everything is recycled or treated sufficiently to be returned to a natural surface water.

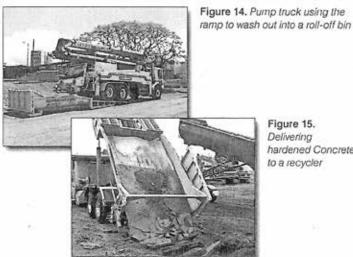


Figure 15. Delivering hardened Concrete

to a recycler

Another metal, portable, washout container, which has a rain cover to prevent overflowing, is shown in Figure 16. It is accompanied by an onsite washwater treatment unit, which reduces the pH and uses a forced weir tank system to remove the coarse aggregate, fine aggregate, and cement fines. The

washwater can then be reused at the construction site to wash out other mixer truck chutes and equipment. The solids are allowed to harden together and can be taken to a concrete recycler (Fig. 17) to be crushed and used as road base or aggregate for making precast products, such as retaining wall blocks. All

materials are recycled.



Figure 16. Washout container with a rain cover and onsite washwater treatment



Figure 17. Delivering hardened concrete to a recycler

Siting Washout Facilities

Concrete washout facilities, such as washout pits and vinyl or metal washout containers, should be placed in locations that provide convenient access to concrete trucks, preferably near the area where concrete is being poured. However they

should not be placed within 50 feet of storm drains, open litches, or waterbodies. Appropriate gravel or rock should cover approaches to concrete washout facilities when they are located on undeveloped property. On large sites with extensive concrete work, washouts should be placed at multiple locations for ease of use by ready mixed truck drivers. If the washout facility is not within view from the pour location, signage will be needed to direct the truck drivers.

Operating and Inspecting Washout Facilities

Concrete washout facilities should be inspected daily and after heavy rains to check for leaks, identify any plastic linings and sidewalls have been damaged by construction activities, and determine whether they have been filled to over 75 percent capacity. When the washout container is filled to over 75 percent of its capacity, the washwater should be vacuumed off or allowed to evaporate to avoid overflows. Then when the remaining cementitious solids have hardened, they should be removed and recycled. Damages to the container should be repaired promptly. Before heavy rains, the washout container's liquid level should be lowered or the container should be covered to avoid an overflow during the rain storm.

Educating Concrete Subcontractors

The construction site superintendent should make ready mixed truck drivers aware of washout facility locations and be watchful for improper dumping of cementitious material. In addition, concrete washout requirements should be included in contracts with concrete delivery companies.

Reference

NRMCA 2009. Environmental Management in the Ready Mixed Concrete Industry, 2PEMRM, 1st edition. By Gary M. Mullins. Silver Springs, MD: National Ready Mixed Concrete Association.

Websites and Videos

Construction Materials Recycling Association www.concreterecycling.org

National Ready Mixed Concrete Association www.nrmca.org

National Ready Mixed Concrete Research and Education Foundation

www.rmc-foundation.org

Additional information and videos on concrete washout containers and systems can be found by a web search for "concrete washout."

Photograph Credits

Figures 1, 2. Mark Jenkins, Concrete Washout Systems, Inc.

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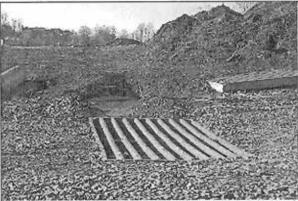
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Minimum Measure: Construction Site Stormwater Runoff Control

Subcategory: Sediment Control

Description

The purpose of stabilizing entrances to a construction site is to minimize the amount of sediment leaving the area as mud and sediment attached to vehicles. Installing a pad of gravel over filter cloth where construction traffic leaves a site can help stabilize a construction entrance. As a vehicle drives over the pad, the pad removes mud and sediment from the wheels and reduces soil transport off the site. The filter cloth separates the gravel from the soil below, keeping the gravel from trucks leave construction sites being ground into the soil. The



Stabilized construction entrances allow dirt to be removed from tire treads and collected as

fabric also reduces the amount of rutting caused by vehicle tires. It spreads the vehicle's weight over a soil area larger than the tire width.

In addition to using a gravel pad, a vehicle washing station can be established at the site entrance. Using wash stations routinely can remove a lot of sediment from vehicles before they leave the site. Diverting runoff from vehicle washing stations into a sediment trap helps to make sure the sediment from vehicles stays onsite and is handled properly.

Applicability

Typically, stabilized construction entrances are installed where construction traffic leaves or enters an existing paved road. But site entrance stabilization should be extended to any roadway or entrance where vehicles enter or leave the site. From a public relations point of view, stabilizing construction site entrances can be worth the effort. If the site entrance is the most noticeable part of a construction site, stabilizing the entrance can improve both the appearance and the public perception of the construction project.

Siting and Design Considerations

Stabilize all entrances to a site before construction and further site disturbance begin. Make sure the stabilized site entrances are long and wide enough to allow the largest construction vehicle that will enter the site to fit through with room to spare. If many vehicles are expected to use an entrance in any one day, make the site entrance wide enough for two vehicles to pass at the same time with room on either side of each vehicle. If a site entrance leads to a paved road, make the end of the entrance flared so that long vehicles do not leave the stabilized area when they turn onto or off the paved roadway. If a construction site entrance crosses a stream, swale, or other depression, provide a bridge or culvert to prevent erosion from unprotected banks. Make sure stone and gravel used to stabilize the construction site entrance are large enough so that they are not carried offsite by vehicles. Avoid sharp-edged stone to reduce the possibility of puncturing tires. Install stone or gravel at a depth of at least 6 inches for the entire length and width of the stabilized construction entrance.

Limitations

Although stabilizing a construction entrance reduces the amount of sediment leaving a site, some soil might still be deposited from vehicle tires onto paved surfaces. To further reduce the chance of these sediments polluting stormwater runoff, sweep the paved area adjacent to the stabilized site entrance. For sites that use wash stations, a reliable water source to wash vehicles before leaving the site might not be initially available. Water might have to be trucked to the site at additional cost.

Maintenance Considerations

Maintain stabilization of the site entrances until the rest of the construction site has been fully stabilized. You might need to add stone and gravel periodically to each stabilized construction site entrance to keep the entrance effective. Sweep up soil tracked offsite immediately for proper disposal. For sites with wash racks at each site entrance, construct sediment traps and maintain them for the life of the project. Periodically remove sediment from the traps to make sure they keep working.

Effectiveness

Stabilizing construction entrances to prevent sediment transport offsite is effective only if all the entrances to the site are stabilized and maintained. Stabilizing the site entrances might not be very effective unless a wash rack is installed and routinely used (Corish, 1995). This can be problematic for sites with multiple entrances and high vehicle traffic.

Cost Considerations

Without a wash rack, construction site entrance stabilization costs range from \$1,000 to \$4,000. On average, the initial construction cost is around \$2,000 per entrance. Including maintenance costs for a 2-year period, the average total annual cost is approximately \$1,500. If a wash rack is included in the construction site entrance stabilization, the initial construction costs range from \$1,000 to \$5,000, and the average initial cost is \$3,000 per entrance. The total cost, including maintenance for an estimated 2-year life span, is approximately \$2,200 per year (USEPA, 1993).

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Fiber Rolls

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Minimum Measure: Construction Site Stormwater Runoff Control

Subcategory: Sediment Control

Description

Fiber rolls (also called fiber logs or straw wattles) are tube-shaped erosion-control devices filled with straw, flax, rice, coconut fiber material, or composted material. Each roll is wrapped with UV-degradable polypropylene netting for longevity or with 100 percent biodegradable materials like burlap, jute, or coir. Fiber rolls complement permanent best management practices used for source control and revegetation. When installed in combination with straw mulch, erosion control blankets, hydraulic mulches, or bounded fiber matrices for slope stabilization, these devices reduce the Photo from Earth Saver Erosion Control effects of long or steep slopes (Earth Saver | Products, 2005. Erosion Control Products, 2005). Fiber rolls



also help to slow, filter, and spread overland flows. This helps to prevent erosion and minimizes rill and gully development. Fiber rolls also help reduce sediment loads to receiving waters by filtering runoff and capturing sediments.

Applicability

Fiber rolls can be used in areas of low shear stress. Avoid using them in channels that are actively incising or in reaches with large debris loads or potential for significant ice buildup (Maryland Department of the Environment, 2000). Fiber rolls have been used to control erosion in a variety of areas--along highways and at construction sites, golf courses, ski areas, vineyards, and reclaimed mines. According to the California Stormwater Quality Association (CASQA, 2003), fiber rolls can be suitable in the following settings:

- Along the toe, top, face, and at-grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow
- At the end of a downward slope where it transitions to a steeper slope
- · Along the perimeter of a project
- · As check dams in unlined ditches
- Downslope of exposed soil areas
- Around temporary stockpiles

Siting and Design Considerations

Fiber rolls should be prefabricated rolls or rolled tubes of geotextiles fabric. When rolling the tubes, make sure each tube is at least 8 inches in diameter. Bind the rolls at each end and every 4 feet along the length of the roll with jute-type twine (California Stormwater Quality Association, 2003).

Slope ground projects

On slopes, install fiber rolls along the contour with a slight downward angle at the end of each row to prevent ponding at the midsection (California Straw Works, 2005). Turn the ends of each fiber roll upslope to prevent runoff from flowing around the roll. Install fiber rolls in shallow trenches dug 3 to 5 inches deep for soft, loamy soils and 2 to 3 inches deep for hard, rocky soils. Determine the vertical spacing for slope installations on the basis of the slope gradient and soil type. According to California Straw Works (2005), a good rule of thumb is:

1:1 slopes = 10 feet apart

2:1 slopes = 20 feet apart

3:1 slopes = 30 feet apart

4:1 slopes = 40 feet apart

For soft, loamy soils, place the rows closer together. For hard, rocky soils, place the rows farther apart. Stake fiber rolls securely into the ground and orient them perpendicular to the slope. Biodegradable wood stakes or willow cuttings are recommended. Drive the stakes through the middle of the fiber roll and deep enough into the ground to anchor the roll in place. About 3 to 5 inches of the stake should stick out above the roll, and the stakes should be spaced 3 to 4 feet apart. A 24-inch stake is recommended for use on soft, loamy soils. An 18-inch stake is recommended for use on hard, rocky soils.

Projects without slopes

Fiber rolls can also be used at projects with minimal slopes. Typically, the rolls are installed along sidewalks, on the bare lot side, to keep sediment from washing onto sidewalks and streets and into gutters and storm drains. For installations along sidewalks and behind street curbs, it might not be necessary to stake the fiber rolls, but trenches must still be dug. Fiber rolls placed around storm drains and inlets must be staked into the ground. These rolls should direct the flow of runoff toward a designated drainage



Photo from IECA, 2005.

area. Place them 1 to 11/2 feet back from the storm drain or inlet.

Limitations

The installation and overall performance of fiber rolls have several limitations, including the following (California Stormwater Quality Association, 2003):

- Fiber rolls are not effective unless trenched.
- Fiber rolls can be difficult to move once saturated.
- To be effective, fiber rolls at the toe of slopes greater than 5:1 must be at least 20 inches in diameter. An equivalent installation, such as stacked smaller-diameter fiber rolls, can be used to achieve a similar level of protection.
- · If not properly staked and entrenched, fiber rolls can be transported by high flows.
- Fiber rolls have a very limited sediment capture zone.
- Fiber rolls should not be used on slopes subject to creep, slumping, or landslide.

Maintenance Considerations

The maintenance requirements of fiber rolls are minimal, but short-term inspection is recommended to ensure that the rolls remain firmly anchored in place and are not crushed or damaged by equipment traffic (Murphy and Dreher, 1996). Monitor fiber rolls daily during prolonged rain events. Repair or replace split, torn, unraveled, or slumping fiber rolls. Fiber rolls are typically left in place on slopes. If they are removed, collect and dispose of the accumulated sediment. Fill and compact holes, trenches, depressions, or any other ground disturbance to blend with the surrounding landscape.

Effectiveness

Unlike other BMPs that could cause water to back up and flow around the edges, fiber rolls allow water to flow through while capturing runoff sediments. Fiber rolls placed along the shorelines of lakes and ponds provide immediate protection by dissipating the erosive force of small waves. As an alternative to silt fences, fiber rolls have some distinct advantages, including the following (Earth Saver, 2005):

- · They install more easily, particularly in shallow soils and rocky material.
- They are more adaptable to slope applications and contour installations than other erosion and sediment control practices.
- They are readily molded to fit the bank line.
- They blend in with the landscape and are less obtrusive than other erosion and sediment controls such as silt fence.
- They do not obstruct hydraulic mulch and seed applications.
- They can be removed or left in place after vegetation is established.

Fiber rolls can provide slope protection for 3 to 5 years (California Straw Works, 2005). They slowly decompose into mulch, and the netting breaks down into small pieces. The San Diego State University Soil Erosion Research Laboratory reported that the use of fiber roll products reduced offsite sediment delivery by 58 percent (International Erosion Control Association, 2005).

The Flint Creek watershed, which covers approximately 28 square miles of Lake and Cook counties in northeastern Illinois, was listed in the Illinois Water Quality Report (1994-1995) as being impaired due to nonpoint source pollution from land development, channelization, and urban runoff. Along with other bioengineering techniques, fiber rolls were installed along the shorelines of the creek to reduce the effects of wave action. Native plants were installed in the fiber rolls. As a result, the growth of vegetative cover increased and helped to stabilize the slopes along the banks of the creek. Ultimately, the water quality of Flint Creek was improved (USEPA, 2002).

Cost Considerations

Material costs for fiber rolls range from \$20 to \$30 per 25-foot roll (CASQA, 2003). Labor hours should also be allocated for installation, monitoring, and maintenance. Because fiber rolls are usually left along slopes and are biodegradable, labor costs for removing them are avoided. However, sediment removal and disposal are still necessary in areas where sediment accumulates to at least one-half the distance between the top of the fiber roll and the ground surface.

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Minimum Measure: Construction Site Stormwater Runoff Control

Subcategory: Good Houskeeping/Materials Management

Description

Building materials and other construction site wastes must be properly managed and disposed of to reduce the risk of pollution from materials such as surplus or refuse building materials or hazardous wastes. Practices such as trash disposal, recycling, proper material handling, and spill prevention and cleanup measures can reduce the potential for stormwater runoff to mobilize construction site wastes and contaminate surface or ground water.

Applicability

The proper management and disposal of wastes should be practiced at every construction site to reduce stormwater runoff. Use waste management practices to properly locate refuse piles, to cover materials that might be displaced by rainfall or stormwater runoff, and to prevent spills and leaks from hazardous materials that were improperly stored.

Siting and Design Considerations

Solid Wastes:

- Designate a waste collection area on the site that does not receive a substantial amount of runoff from upland areas and does not drain directly to a waterbody.
- · Ensure that containers have lids so they can be covered before periods of rain, and keep containers in a covered area whenever possible.
- Schedule waste collection to prevent the containers from overfilling.
- · Clean up spills immediately. For hazardous materials, follow cleanup instructions on the package. Use an absorbent material such as sawdust or kitty litter to contain the
 - During the demolition phase of construction, provide extra containers and schedule more frequent pickups.
 - Collect, remove, and dispose of all construction site wastes at authorized disposal areas. Contact a local environmental agency to identify these disposal sites.

Hazardous Materials and Wastes:

 Consult with local waste management authorities about the requirements for disposing of hazardous materials.

- · To prevent leaks, empty and clean hazardous waste containers before disposing of
- Never remove the original product label from the container because it contains important safety information. Follow the manufacturer's recommended method of disposal, which should be printed on the label.
- Never mix excess products when disposing of them, unless specifically recommended by the manufacturer.

To ensure the proper disposal of contaminated soils that have been exposed to and still contain hazardous substances, consult with state or local solid waste regulatory agencies or private firms. Some landfills might accept contaminated soils, but they require laboratory tests first.

Paint and dirt are often removed from surfaces by sandblasting. Sandblasting grits are the byproducts of this procedure and consist of the sand used and the paint and dirt particles that are removed from the surface. These materials are considered hazardous if they are removed from older structures because they are more likely to contain lead-, cadmium-, or chrome-based paints. To ensure proper disposal of sandblasting grits, contract with a licensed waste management or transport and disposal firm.

Pesticides and fertilizers:

- Follow all federal, state, and local regulations that apply to the use, handling, or disposal of pesticides and fertilizers.
- Do not handle the materials any more than necessary.
- Store pesticides and fertilizers in a dry, covered area.
- Construct berms or dikes to contain stored pesticides and fertilizers in case of spillage.
- Follow the recommended application rates and methods.
- · Have equipment and absorbent materials available in storage and application areas to contain and clean up any spills that occur.

Petroleum Products:

- Store new and used petroleum products for vehicles in covered areas with berms or dikes in place to contain any spills.
- Immediately contain and clean up any spills with absorbent materials.
- · Have equipment available in fuel storage areas and in vehicles to contain and clean up any spills that occur.

Detergents:

Phosphorous- and nitrogen-containing detergents are used in wash water for cleaning vehicles. Excesses of these nutrients can be a major source of water pollution. Use detergents only as recommended, and limit their use on the site. Do not dump wash water containing detergents into the storm drain system; direct it to a sanitary sewer or contain it so that it can be treated at a wastewater treatment plant.

Limitations

An effective waste management system requires training and signage to promote awareness of the hazards of improper storage, handling, and disposal of wastes. The only way to be sure that waste management practices are being followed is to be aware of worker habits and to inspect storage areas regularly. Extra management time may be required to ensure that all workers are following the proper procedures.

Maintenance Considerations

Inspect storage and use areas and identify containers or equipment that could malfunction and cause leaks or spills. Check equipment and containers for leaks, corrosion, support or foundation failure, or other signs of deterioration, and test them for soundness. Immediately repair or replace any that are found to be defective.

Effectiveness

Waste management practices are effective only when they are regularly practiced at a construction site. In storage and use areas, post the guidelines for proper handling, storage, and disposal of construction site wastes; train workers in these practices to ensure that everyone is knowledgeable enough to participate.

Cost Considerations

The costs associated with construction site waste management are mainly attributed to purchasing and posting signs, increased management time for oversight, additional labor required for special handling of wastes, transportation costs for waste hauling, and fees charged by disposal facilities to take the wastes.

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Geotextiles

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Minimum Measure: Construction Site Stormwater Runoff Control

Subcategory: Erosion Control

Description

Geotextiles are porous fabrics also known as filter fabrics, road rugs, synthetic fabrics, construction fabrics, or simply fabrics. Geotextiles are manufactured by weaving or bonding fibers that are often made of synthetic materials such as polypropylene, polyester, polyethylene, nylon, polyvinyl chloride, glass, and various mixtures of these materials. As a synthetic construction material, geotextiles are used for a variety of purposes such as separators, reinforcement, filtration and drainage, and erosion control (USEPA, 1992). Some geotextiles are made of biodegradable materials such as mulch matting and netting. Mulch mattings are jute or other wood fibers that have been formed into sheets and are more stable than normal mulch. Netting is typically made from jute, wood fiber, plastic, paper, or cotton and can be used to hold the mulching and matting to the ground. Netting can also be used alone to stabilize soils while the plants are growing; however, it does not retain moisture or temperature well. Mulch



Geotextile mats not only protect ground surfaces from wind and stormwater erosion but also allow vegetative growth (Source: Rolanka International, 2000)

binders (either asphalt or synthetic) are sometimes used instead of netting to hold loose mulches together. Geotextiles can aid in plant growth by holding seeds, fertilizers, and topsoil in place. Fabrics come in a wide variety to match the specific needs of the site and are relatively inexpensive for certain applications.

Applicability

Geotextiles can be used in various ways for erosion control on construction sites. Use them as matting to stabilize the flow of channels or swales or to protect seedlings on recently planted slopes until they become established. Use matting on tidal or stream banks, where moving water is likely to wash out new plantings. Geotextiles can be used to protect exposed soils immediately and temporarily, such as when active piles of soil are left overnight. They can also be used as a separator between riprap and soil, which prevents the soil from being eroded from beneath the riprap and maintains the riprap's base.

Siting and Design Considerations

There are many types of geotextiles available; therefore, the selected fabric should match its purpose. To ensure the effective use of geotextiles, keep firm, continuous contact between the materials and the soil. If there is no contact, the material will not hold the soil, and erosion will occur underneath the material.

Limitations

Geotextiles (primarily synthetic types) have the potential disadvantage of disintegrating when exposed to light. Consider this before installing them. Some geotextiles might increase runoff or blow away if not firmly anchored. Depending on the type of material used, geotextiles might need to be disposed of in a landfill, making them less desirable than vegetative stabilization. If the geotextile fabric is not properly selected, designed, or installed, its effectiveness may be reduced drastically.

Maintenance Considerations

Inspect geotextiles regularly to determine if cracks, tears, or breaches have formed in the fabric; if so, repair or replace the fabric immediately. It is necessary to maintain contact between the ground and the geotextile at all times. Remove trapped sediment after each storm event.

Effectiveness

Geotextiles' effectiveness depends on the strength of the fabric and proper installation. For example, when protecting a cut slope with a geotextile, it is important to properly anchor the fabric. This will ensure that it will not be undermined by a storm event.

Cost Considerations

Costs for geotextiles range from \$0.50 to \$10.00 per square yard, depending on the type chosen (SWRCP, 1991).

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Land Grading

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Minimum Measure: Construction Site Stormwater Runoff Control

Subcategory: Construction Site Planning and Management

Description

Land grading involves reshaping the ground surface to planned grades as determined by an engineering survey, evaluation, and layout. Land grading provides more suitable topography for buildings, facilities, and other land uses and helps to control surface runoff, soil erosion, and sedimentation during and after construction.

Applicability

Land grading is applicable to sites with uneven or steep topography

Soils exposed from land grading activities are very vulnerable to erosion

or easily erodible soils, because it stabilizes slopes and decreases runoff velocity. Grading activities should maintain existing drainage patterns as much as possible.

Siting and Design Considerations

Before grading activities begin, a construction site operator must make decisions regarding the steepness of cut-and-fill slopes and how the slopes will be

- Protected from runoff
- Stabilized
- Maintained

Prepare a grading plan that establishes which areas of the site will be graded, how drainage patterns will be directed, and how runoff velocities will affect receiving waters. Also in the grading plan, include information about when earthwork will start and stop, establish the degree and length of finished slopes, and dictate where and how excess material will be disposed of (or where borrow materials will be obtained if needed). Land grading should be a key consideration for Construction Sequencing. Try to minimize exposed soils at any given time during construction. Incorporate in the plan any berms, diversions, and other stormwater practices that require excavation and filling.

Care should be taken if blasting agents or explosives are used. These products may contain perchlorates, which are water soluble chemicals. If explosives containing perchlorate must be used, then good housekeeping practices should be employed to ensure that any debris is properly disposed.

A low-impact development BMP that a site operator can incorporate into a grading plan is site fingerprinting, which involves clearing and grading only those areas necessary for building activities and equipment traffic. Maintaining undisturbed temporary or permanent buffer zones in the grading operation provides a low-cost sediment control measure that will help reduce runoff and offsite sedimentation. Let the lowest elevation of the site remain undisturbed to provide a protected stormwater outlet before storm drains or other construction outlets are installed.

Limitations

Improper grading practices that disrupt natural stormwater patterns might lead to poor drainage, high-runoff velocities, and increased peak flows during storm events. Clearing and grading the entire site without vegetated buffers promotes offsite transport of sediments and other pollutants. Design the grading plan with erosion and sediment control and stormwater management goals in mind; to ensure that the plan is implemented as intended, carefully supervise grading crews.

Maintenance Considerations

Check all graded areas and supporting erosion and sediment control practices periodically, especially after heavy rainfalls. Promptly remove all sediment from diversions or other stormwater conveyances, and if washouts or breaks occur, repair them immediately. To prevent small-scale eroded areas from becoming significant gullies, maintain them promptly.

Effectiveness

Land grading is an effective way to reduce steep slopes and stabilize highly erodible soils when properly implemented with stormwater management and erosion and sediment control practices. Land grading is not effective when drainage patterns are altered or when vegetated areas on the perimeter of the site are destroyed (USEPA, 2004).

Cost Considerations

Land grading is practiced at virtually all construction sites. It can take a certified engineer or landscape architect several hours of work to incorporate stormwater and erosion and sediment controls in the grading plan. It might take extra time to excavate diversions and construct berms. Also, fill materials might be needed to build up lowlying areas or fill depressions. Where grading is performed to manage on-site stormwater, the cost of fine grading, soil treatment, and grassing is approximately \$2 per square yard of earth surface area and shallow excavation/trenching (1 to 4 feet deep) with a backhoe in areas not requiring dewatering can be performed for \$4 to \$5 per cubic yard of removed material (R. S. Means, 2000). Larger scale grading requires a site-specific assessment of an alternative grading apparatus and a detailed fill/excavation material balance to retain as much soil on site as possible.

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Mulching

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Minimum Measure: Construction Site Stormwater Runoff Control

Subcategory: Erosion Control

Description

Mulching is an erosion control practice that uses materials such as grass, hay, wood chips, wood fibers, straw, or gravel to stabilize exposed or recently planted soil surfaces. Mulching is highly recommended and is most effective when used in conjunction with vegetation. In addition to stabilizing soils, mulching can reduce stormwater velocity and improve the infiltration of runoff. Mulching can also aid plant growth by holding seeds, fertilizers, and topsoil in place, preventing birds from eating seeds, retaining



Grass mulching is applied to stabilize exposed soils and to reduce stormwater runoff velocity

moisture, and insulating plant roots against extreme temperatures.

Mulch matting is made from materials such as jute or other wood fibers that are formed into sheets and are more stable than loose mulch. Use jute and other wood fibers, plastic, paper, or cotton individually or combine them into mats to hold mulch to the ground. Use netting to stabilize soils while plants are growing; although, netting does not retain moisture or insulate against extreme temperatures. Mulch tackifiers made of asphalt or synthetic materials are sometimes used instead of netting to bind loose mulches.

Applicability

Mulching is often used in areas where vegetation cannot be established. Mulching can provide immediate and inexpensive erosion control. On steep slopes and critical areas, such as those near waterways, use mulch matting with netting or anchoring to hold it in place. Use mulches on seeded and planted areas where slopes are steeper than 2:1 or where sensitive seedlings require insulation from extreme temperatures or moisture retention.

Siting and Design Considerations

When possible, natural mulches should be used for erosion control and plant material establishment. Suggested materials include loose straw, netting, wood cellulose, or agricultural silage. All materials should be free of seed. Anchor loose hay or straw by applying tackifier, stapling netting over the top, or crimping with a mulch crimping tool. Materials that are heavy enough to stay in place (for example, gravel or bark or wood chips on flat slopes) do not need anchoring. Other examples of organic mulches include hydraulic mulch products with 100 percent post-consumer paper content, yard trimming composts, and wood mulch from recycled stumps and tree parts. Use inorganic mulches such as pea gravel or crushed granite in unvegetated areas.

Mulches may or may not require a binder, netting, or tacking. To ensure effective use of netting and matting material, keep firm, continuous contact between the materials and the soil. If there is no contact, the material will not hold the soil and erosion will occur underneath the material. Grading is not necessary before mulching. Use biodegradable netting, if possible.

There must be adequate coverage to prevent erosion, washout, and poor plant establishment. If an appropriate tacking agent is not applied, or is applied in insufficient amounts, mulch will be lost to wind and runoff. The channel grade and liner must be appropriate for the amount of runoff, or the channel bottom will erode. Also, apply hydromulch in spring, summer, or fall to prevent deterioration of mulch before plants can become established. Table 1 presents guidelines for installing mulches.

Table 1. Typical mulching materials and application rates

Material	Rate per acre	Requirements	Notes
Organic Mulches			
Straw	1 - 2 tons	Dry, unchopped, unweathered; avoid weeds	Spread by hand or machine; must be tacked or tied down
Wood fiber or wood cellulose	½ - 1 ton		Use with hydroseeder; may be used to tack straw; do not use in hot, dry weather
Wood chips	5 - 6 tons	Air dry; add fertilizer N, 12 lb/ton	Apply with blower, chip handler, or by hand; not for fine turf areas
Bark	35 yd³	Air dry, shredded, or hammermilled, or chips	Apply with mulch blower, chip handler, or by hand; do not use asphalt tack

Nets and mats		Ĭ.	
Jute net	Cover area	Heavy, uniform; woven of single jute yarn; use with organic mulch	Withstands water flow
Excelsior (wood fiber) mat	Cover area		
Fiberglass roving	½ - 1 ton	Continuous fibers of drawn glass bound together with a non-toxic agent	Apply with compressed air ejector; tack with emulsified asphalt at a rate of 25 - 35 gal/1000 ft ²

Limitations

Mulching, matting, and netting might delay seed germination because the cover changes soil surface temperatures. The mulches themselves are subject to erosion and may be washed away in a large storm. Maintenance is necessary to ensure that mulches provide effective erosion control.

Maintenance Considerations

Anchor mulches to resist wind displacement. When protection is no longer needed, remove netting and compost it or dispose of it in a landfill. Inspect mulched areas frequently to identify areas where it has loosened or been removed, especially after rainstorms. Reseed these areas, if necessary, and replace the mulch cover immediately. Apply mulch binders at rates recommended by the manufacturer. If washout, breakage, or erosion occurs, repair, reseed and remulch surfaces, and install new netting. Continue inspections until vegetation is firmly established.

Effectiveness

Mulching effectiveness varies according to the type of mulch used. Soil loss reduction for different mulches ranges from 53 to 99.8 percent. Water velocity reductions range from 24 to 78 percent. Table 2 shows soil loss and water velocity reductions for different mulch treatments.

Table 2. Measured reductions in soil loss for different mulch treatments (Source: Harding, 1990, as cited in USEPA, 1993)

Mulch characteristics	Soil loss reduction (%)	Water velocity reduction (% relative to bare soil)		
100% wheat straw/top net	97.5	73		
100% wheat straw/two nets	98.6	56		

70% wheat straw/30% coconut fiber	98.7	71
70% wheat straw/30% coconut fiber	99.5	78
100% coconut fiber	98.4	77
Nylon monofilament/two nets	99.8	74
Nylon monofilament/rigid/bonded	53.0	24
Vinyl monofilament/flexible/bonded	89.6	32
Curled wood fibers/top net	90.4	47
Curled wood fibers/two nets	93.5	59
Antiwash netting(jute)	91.8	59
Interwoven paper and thread	93.0	53
Uncrimped wheat straw, 2,242 kg/ha	84.0	. 45
Uncrimped wheat straw, 4,484 kg/ha	89.3	59

Cost Considerations

Costs of seed and mulch average \$1,500 per acre and range from \$800 to \$3,500 per acre (USEPA, 1993).

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Riprap

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Minimum Measure: Construction Site Stormwater Runoff Control

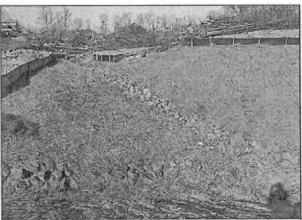
Subcategory: Erosion Control

Description

Riprap is a layer of large stones used to protect soil from erosion in areas of concentrated runoff. Riprap can also be used on slopes that are unstable because of seepage problems.

Applicability

Use riprap to stabilize cut-and-fill slopes; channel side slopes and bottoms; inlets and outlets for culverts, bridges, slope drains, grade stabilization structures, and storm drains; and streambanks and grades.



Riprap can be used to stabilize drainageways and outlets to prevent erosion

Siting and Design Considerations

Riprap can be unstable on very steep slopes, especially when rounded rock is used. For slopes steeper than 2:1, consider using materials other than riprap for erosion protection.

Consider the following design recommendations for riprap installation (Smolen et al., 1988):

- Gradation. Use a well-graded mixture of rock sizes instead of one uniform size.
- · Quality of stone. Use riprap material that is durable so that freeze and thaw cycles do not decompose it in a short time; most igneous stones, such as granite, have suitable durability.
- · Riprap depth. Make the riprap layer at least two times as thick as the maximum stone
- Filter material. Apply a filter material—usually a synthetic cloth or a layer of gravel before applying the riprap. This prevents the underlying soil from moving through the
- Riprap Limits. Place riprap so it extends to the maximum flow depth, or to a point where vegetation will be satisfactory to control erosion.

- · Curves. Ensure that riprap extends to five times the bottom width upstream and downstream of the beginning and ending of the curve and the entire curved section.
- Riprap Size. The size of the riprap material depends on the shear stress of the flows the riprap will be subject to, but it ranges from an average size of 2 inches to 24 inches in diameter (Idaho Department of Environmental Quality, no date).
- Wire Riprap Enclosures. Consider using chain link fencing or wire mesh to secure riprap installations, especially on steep slopes or in high flow areas.

Limitations

The steepness of the slope limits the applicability of riprap, because slopes greater than 2:1 can cause riprap loss due to erosion and sliding. If used improperly, riprap can actually increase erosion. In addition, riprap can be more expensive than other stabilization options.

Maintenance Considerations

Inspect riprap areas annually and after major storms. If riprap has been damaged, repair it promptly to prevent a progressive failure. If repairs are needed repeatedly at a location, evaluate the site to determine if the original design conditions have changed. Also, you might need to control weed and brush growth in some locations.

Effectiveness

When properly designed and installed, riprap can prevent erosion from the protected

Cost Considerations

The cost of riprap varies depending on location and the type of material selected. A cost of \$35 to \$50 per square yard of nongrouted riprap has been reported, while grouted riprap ranges from \$45 to \$60 per square yard (1993 dollars; Mayo et al., 1993).

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Stormwater Best Management Practice

Silt Fences



Minimum Measure

Construction Site Stormwater Runoff Control

Subcategory

Sediment Control

Purpose and Description

The purpose of a silt fence is to retain the soil on disturbed land (Figure 1), such as a construction site, until the activities disturbing the land are sufficiently completed to allow revegetation and permanent soil stabilization to begin. Keeping the



Figure 1. Silt fence retaining sediment

soil on a construction site, rather than letting it be washed off nto natural water bodies (e.g., streams, rivers, ponds, lakes, estuaries) prevents the degradation of aquatic habitats and siltation of harbor channels. And not letting soil wash off onto roads, which readily transport it to storm sewers, avoids having sewers clogged with sediment. The cost of installing silt fences on a watershed's construction sites is considerably less than the costs associated with losing aquatic species, dredging navigation channels, and cleaning sediment out of municipal storm sewers.

A silt fence is a temporary sediment barrier made of porous fabric. It's held up by wooden or metal posts driven into the ground, so it's inexpensive and relatively easy to remove. The fabric ponds sediment-laden stormwater runoff, causing sediment to be retained by the settling processes. A single 100 foot (ft) run of silt fence may hold 50 tons of sediment in place. Most construction sites today do have silt fences. But many do not work effectively because they are not well designed, installed, or maintained. The focus of this fact sheet is—how to make silt fences work.

Design

The three principal aspects of silt fence design are: proper placement of fencing, adequate amount of fencing, and appropriate materials.

Proper Placement of Fencing

Placement is important because where a fence starts, runs, and ends is critical to its effectiveness. Improper placement can make the fence a complete waste of money. Analyze the construction site's contours to determine the proper placement.

Segment the site into manageable sediment storage areas for using multiple silt fence runs. The drainage area above any fence should usually not exceed a quarter of an acre. Water flowing over the top of a fence during a normal rainfall indicates the drainage area is too large. An equation for calculating the maximum drainage area length above a silt fence, measured perpendicular to the fence, is given in Fifield, 2011. Avoid long runs of silt fence because they concentrate the water in a small area where it will easily overflow the fence. The lowest point of the fence in Figure 4 is indicated by a red arrow. Water is directed to this low point by both long runs of fence on either side of the arrow. Most of the water overflows the fence at this low point and little sediment is trapped for such a long fence.



Figure 2. Create manageable sediment storage areas



Figure 3. Water should not flow over the filter fabric during a normal rainfall



Figure 4. Avoid long runs of silt fence

Jse J-hooks as shown in Figures 5 and 6, which have ends urning up the slope to break up long fence runs and provide multiple storage areas that work like mini-retention areas. If the fence doesn't create a ponding condition, it will not work well. The silt fence in Figure 7 doesn't pond water or retain sediment. Stormwater will run around the fence carrying sediment to the street, which will transport the water and its sediment load to the storm sewer inlet.



Figure 5. Use J-hook fences to break up long fence runs



Figure 6. J-hook silt fences provide multiple storage areas

Figure 7. This silt fence doesn't work

Water flowing around the ends of a silt fence will cause additional erosion and defeat its purpose. The bottom of each end of the fence should be higher than the top of the middle of the fence (Figure 8). This insures that during an unusually heavy rain, water will flow over the top rather than around either end of the fence. Only fine suspended material will spill over the top, which is not as harmful as having erosion at the ends. When

there is a long steep slope, install one fence near the head of the slope to reduce the volume and velocity of water flowing down the slope, and another fence 6-10 ft from the toe of the slope to create a sediment storage area near the bottom. A common misconception is that you only have to worry about water running off steep slopes. However, steep slopes may have a relatively small water collection area. The total drainage area



Figure 8. Proper installation, bottom of both ends are above the top of the middle



Figure 9. Poor installation, water can flow around the ends causing additional erosion

of a gentle slope, if large (Figure 10), can be more important than its slope in determining sediment loss. A silt fence should not be placed in a channel with continuous flow (channels in Figures 8 and 9 don't have a continuous flow), nor across a narrow or steep-



Figure 10. Gentle slopes may require a silt fence

sided channel. But when necessary a silt fence can be placed parallel to the channel to retain sediment before it enters the watercourse.

Paved streets are major conduits of stormwater and silt, and they drain to storm sewer inlets. The best solution is to retain as much sediment as possible before it reaches paved surfaces. Install a silt fence at the inlet side of a storm sewer or culvert, rather than at the discharge where there is greater velocity and less storage area. Streets cut in the grade, but not yet paved, are also prime erosion conduits. If the streets are not going to be paved right away, they need a containment barrier such as a silt fence. Finally as a construction site's dynamics change, the silt fence layout should be adjusted when necessary to maintain its effectiveness.

Designers and contractors should also consider diverting sediment-laden runoff water to a sediment detention pond. If the site can provide a large enough area, this is usually the most effective and economical best management practice for retaining sediments. Silt fences are needed when there is insufficient space for a detention pond or when roads and other structures are in the way.

Adequate Amount of Fencing

The amount of fencing means the total linear length of the silt fencing runs on the construction site. A reasonable rule-of -thumb for the proper amount of silt fence is—100 ft of silt fence per 10,000 square foot (sq ft) of disturbed area. Soil type, slope, slope length, rainfall, and site configuration are all important elements in determining the adequate silt fence protection for a site, and to what extent it fits the 100 ft per 10,000 sq ft rule-of-thumb. If the amount of fencing provides the volume of runoff storage needed, then over-flowing the silt fence runs will be minimized. This is the basic test; if fences are over-flowing after a moderate rainfall event, the amount of fencing probably needs to be increased to avoid undercutting, washouts, and fence failures.

'ppropriate Materials

There are different types of porous fabrics available, e.g., woven, non-woven, mono-filament, but all types tend to clog rapidly and don't provide lasting filtration. The support posts and installation method are more important than the fabric type for overall sediment retention. However, a lightweight fabric tends to tear where it is attached to the posts. Posts must hold the fabric up and support the horizontal load of retained water and sediment. Hardwood posts (2" x 2") are potentially strong enough to support the loads, but are difficult to drive into the ground more than 6-8". To hold 2 ft of sediment and water, the posts should be driven 2 ft into the ground. Steel posts are best because they can be driven into compacted soil to a depth of 2 ft. The support posts should be spaced 3-4 ft apart where water may run over the top of the fence, 5 ft in most other areas, and 6-7 ft where there isn't a considerable horizontal load. Improper post depth and spacing is often the cause of sagging fabric and falling posts. Some authorities believe a more robust wire or chain link supported silt fence is needed to withstand heavy rain events. However, this may double the cost of a silt fence installation and entails disposing of more material in a landfill when the fence is removed. Installing silt fencing having five interacting features: (1) proper placement ased on the site's contours, (2) adequate amount of fencing without long runs, (3) heavy porous filter fabric, (4) metal posts

with proper depth and spacing, and (5) tight soil compaction on both sides of the silt fence will usually obviate the need for wire or chain link reinforced fencing. Prefabricated silt fences, e.g., fabric attached to wooden posts in a 100 ft package, doesn't provide for posting after the ground is compacted or allow variable post spacing.



Figure 11. Chain link supported silt fence

Silt Fence Installation

Two commonly used approaches for installing silt fences are the static slicing method and the trenching method.

Static Slicing Method

The static slicing machine pulls a narrow blade through the ground to create a slit 12" deep, and simultaneously inserts the silt fence fabric into this slit behind the blade. The blade is designed to slightly disrupt soil upward next to the slit and to minimize horizontal compaction, thereby creating an optimum condition for compacting the soil vertically on both sides of the fabric. Compaction is achieved by rolling a tractor wheel along both sides of the slit in the ground 2 to 4 times to achieve nearly the same or greater compaction as the original undisturbed soil. This vertical compaction reduces the air spaces between soil particles, which minimizes infiltration. Without this compaction infiltration can saturate the soil, and water may find a pathway under the fence. When a silt fence is holding back several tons of accumulated water and sediment, it needs to be supported by posts that are driven 2 ft into wellcompacted soil. Driving in the posts and attaching the fabric to them completes the installation.



Figure 12. Static slicing machine



Figure 13. Tractor wheel compacting the soil

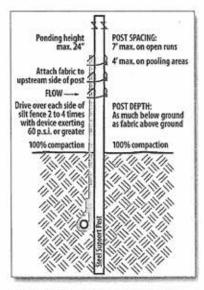


Figure 14. Silt fence installation using the static slicing method

Trenching Method

Trenching machines have been used for over twenty-five years to dig a trench for burying part of the filter fabric underground. Usually the trench is about 6" wide with a 6" excavation. Its

walls are often more curved than vertical, so they don't provide as much support for the posts and fabric. Turning the trencher is necessary to maneuver around obstacles, follow terrain contours or property lines, and install upturns or J-hooks. But trenchers



Figure 15. Trenchers make a wider excavation at turns



Figure 16. Poor compaction has resulted in infiltration and water flowing under this silt fence causing retained sediment washout

can't turn without making a wider excavation, and this results in poorer soil compaction, which allows infiltration along the underground portion of the fence. This infiltration leads to water seeking pathways under the fence, which causes subsequent soil

erosion and retained sediment washout under the fence. The white line on the fence in Figure 16 and red arrow both mark the previous sediment level before the washout. Post setting and fabric installation often precede compaction, which make effective compaction more difficult to achieve. EPA supported an independent technology evaluation (ASCE 2001), which compared three progressively better variations of the trenching method with the static slicing method. The static slicing method performed better than the two lower performance levels of the trenching method, and was as good or better than the trenching method typically required nearly triple the time and effort to achieve results comparable to the static slicing method.

Proper Attachment

Regardless of the installation method, proper attachment of the fabric to the posts is critical to combining the strength of the fabric and support posts into a unified structure. It must be able to support 24" of sediment and water. For steel posts use three plastic ties per post (50 lb test strength), located in the top 8" of the fabric, with each tie hung on a post nipple, placed diagonally to attach as many vertical and horizontal threads as possible. For wooden posts use several staples per post, with a wood lath to overlay the fabric.

Perimeter Silt Fences

When silt fences are placed around the perimeter of a stock pile or a construction site, the conventional silt fence design and materials discussed previously may not be sufficient.

Stock pile example. A stock pile of dirt and large rocks is shown in Figures 17 and 18 with a silt fence protecting a portion of its perimeter. Rocks that roll down the pile would likely



Figure 17. Back of silt fence on part of the stock pile's perimeter

damage a conventional silt fence. The bottom of the porous fabric is held firmly against both the ground and base of precast concrete, highway, barriers by light-colored stones. An alternative installation would be having the concrete barriers rest directly on the



Figure 18. Front of silt fence on part of stock pile's perimeter

bottom edge of the filter fabric, which would extend under the barriers about 10", so the barriers' weight will press the fabric against the ground to prevent washout. Water passing through the silt fence (red arrow in Figure 18) flows to a storm sewer culvert inlet, which is surrounded by a fabric silt fence (yellow arrows in Figures 17 and 18) that reduces the runoff's velocity and allows settling before the water is discharged to a creek.

Bridge abutment example. During the construction of a bridge over a river between two lakes, an excavation on the river bank was needed to pour footings for the bridge abutment. The silt fence along the excavation's perimeter, composed of concrete highway barriers with orange filter fabric, was designed to

prevent stormwater from washing excavated spoil into the river and to fend off the river during high flows. A portion of the orange filter fabric that has blown away from the concrete barriers shows the need to overlap and reinforce the joints where two sections of filter fabric are attached.

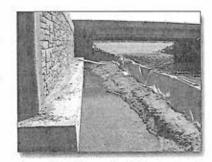


Figure 19. Silt fence for bridge abutment excavation

Highway example. Because of the proximity of a construction site to a highway, a concrete barrier was required by Minnesota's

DOT to protect the highway and an underground fiber optic cable next to the highway from construction activities. The concrete barrier was used to support a silt fence along the perimeter of a large amount of dirt that was stock piled before being used for fill at a different location.



Figure 20. Silt fence protecting a highway and underground fiber optics



Figure 21. Silt lence protecting a lake shore

Lake shore example.

The lake's shoreline is being restored with plant plugs and seeded with native plant species. A plywood, perimeter, silt fence is used to trap sediment from a construction site on the right-side of the picture, protect the lake shore from

boat-wake erosion, and to prevent geese from eating the seeds and young plants. This fencing will be removed when 70% vegetative cover is achieved.

Inspection and Maintenance



Figure 22. A silt fence full of sediment hat needs maintenance

Silt fences should be inspected routinely and after runoff events to determine whether they need maintenance because they are full (Figure 22) or damaged by construction equipment. The ASTM silt fence specification

(ASTM 2003) recommends removing sediment deposits from behind the fence when they reach half the height of the fence or installing a second fence. However, there are several problems associated with cleaning out silt fences. Once the fabric is clogged with sediment, it can no longer drain slowly and function as originally designed. The result is normally a low volume sediment basin because the cleaning process doesn't unclog the fabric. The soil is normally very wet behind a silt fence, inhibiting the use of equipment needed to move it. A back hoe is commonly used, but, if the sediment is removed, what is to be done with it during construction? Another solution is to leave the sediment in place where it is stable and build a new silt fence above or below it to collect additional sediment as shown in Figure 23. The proper maintenance may be

site specific, e.g. small construction sites might not have sufficient space for another silt fence. Adequate access to the sediment control devices should be provided so inspections and maintenance can be performed.



Figure 23. New silt fence below the old fence

Permanent Soil Stabilization

When the land disturbing activities are sufficiently completed to allow permanent soil stabilization on the site, the silt fences and sediment basins are removed. The fabric and damaged posts go to the landfill. Steel posts and some of the wooden posts can be reused. Then the sediment is spread over the site to provide fertile soil, and the area can be seeded and mulched to support revegetation.

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Sediment Basins and Rock Dams

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Minimum Measure: Construction Site Stormwater Runoff Control

Subcategory: Sediment Control

Description

Sediment basins and rock dams can be used to capture sediment from stormwater runoff before it leaves a construction site. Both structures allow a pool to form in an excavated or natural depression, where sediment can settle. The pool is dewatered through a single riser and drainage hole leading to a suitable outlet on the downstream side of the embankment or through the gravel of the rock dam. The water is released more slowly than it would be without the control structure.



Sediment basins are used to trap sediments and temporarily detain runoff on larger construction sites

A sediment basin is constructed by excavation or by erecting an earthen embankment across a low area or drainage swale. The basin can be temporary (up to 3 years) or permanent. Some sediment basins are designed to drain completely during dry periods. Others are constructed so that a shallow pool of water remains between storm events.

Rock dams are similar to sediment basins with earthen embankments. These damming structures are constructed of rock and gravel. They release water from the settling pool gradually through the spaces between the rocks.

Applicability

Sediment basins are usually used for drainage areas of 5 to 100 acres. They can be temporary or permanent. Sediment basins designed to be used for up to 3 years are usually described as temporary. Those designed for longer service are considered permanent. Temporary sediment basins can be converted into permanent stormwater runoff management ponds, but they must meet all regulatory requirements for wet ponds.

For EPA Construction General Permit permittees, a sediment basin or its equivalent should accomplish the following for drainage areas of different sizes:

 10 or more acres of disturbed area: For common drainage locations that serve an area with 10 or more acres disturbed at one time, a temporary (or permanent) sediment basin that provides storage for a calculated volume of runoff from the drainage area from a 2-year, 24-hour storm, or equivalent control measures, must be provided where attainable until final stabilization of the site. Where no such calculation has been performed, a temporary (or permanent) sediment basin providing 3,600 cubic feet of storage per acre drained, or equivalent control measures, must be provided where attainable until final stabilization of the site. When computing the number of acres draining into a common location, it is not necessary to include flows from offsite areas and flows from on-site areas that are either undisturbed or have undergone final stabilization where such flows are diverted around both the disturbed area and the sediment basin. In determining whether installing a sediment basin is attainable, the operator may consider factors such as site soils, slope, available area on-site, etc. In any event, the operator must consider public safety, especially as it relates to children, as a design factor for the sediment basin, and alternative sediment controls must be used where site limitations would preclude a safe design.

For drainage locations which serve 10 or more disturbed acres at one time and where a temporary sediment basin or equivalent controls is not attainable, smaller sediment basins and/or sediment traps should be used. At a minimum, silt fences, vegetative buffer strips, or equivalent sediment controls are required for all down slope boundaries (and for those side slope boundaries deemed appropriate as dictated by individual site conditions).

· Less than 10 acres of disturbed area: For drainage locations serving less than 10 acres, smaller sediment basins and/or sediment traps should be used. At a minimum, silt fences, vegetative buffer strips, or equivalent sediment controls are required for all down slope boundaries (and for those side slope boundaries deemed appropriate as dictated by individual site conditions) of the construction area unless a sediment basin providing storage for a calculated volume of runoff from a 2-year, 24-hour storm or 3,600 cubic feet of storage per acre drained is provided.

Sediment basins are applicable in drainage areas where it is expected that other erosion controls, such as sediment traps, will not adequately prevent offsite transport of sediment. Whether to construct a sediment basin or a rock dam depends on the materials available, the location of the basin, and the desired capacity for holding stormwater runoff and settling sediment.

Rock dams are suitable where earthen embankments would be difficult to construct and where rocks for the dams are readily available. They are also desirable where the top of the dam structure is to be used as an overflow outlet. Rock dams are best for drainage areas of less than 50 acres. Earthen damming structures are appropriate where failure of the dam will not result in substantial damage or loss of property or life. If sediment basins with earthen dams are properly constructed, they can handle runoff from drainage basins as large as 100 acres.

Siting and Design Considerations

Investigate potential sites for sediment basins during the initial site evaluation. Construct the basins before any grading takes place in the drainage area. For permanent structures, a qualified professional engineer experienced in designing dams should complete the basin design.

Limit sediment basins with rock dams to a drainage area of 50 acres. Limit the rock dam height to 8 feet with a top width of at least 5 feet. Side slopes for rock dams should be no steeper than 2:1 on the basin side of the structure and 3:1 on the outlet side. Cover the basin side of the rock dam with fine gravel from top to bottom for at least 1 foot. This slows the drainage rate from the pool that forms and gives sediments time to settle. The detention time should be at least 8 hours.

Outfit sediment basins with earthen embankments with a dewatering pipe and riser set just above the sediment removal cutoff level. Place the riser pipe at the deepest point of the basin and make sure it extends no farther than 1 foot below the level of the earthen dam. Place a water-permeable cover over the primary dewatering riser pipe to prevent trash and debris from entering and clogging the spillway. To provide an additional path for water to enter the primary spillway, you can drill secondary dewatering holes near the base of the riser pipe, but make sure you protect the holes with gravel to keep sediment out of the spillway piping.

To ensure adequate drainage, use the following equation to approximate the total area of dewatering holes for a particular basin (Smolen et al., 1988):

$$A_0 = (A_s \times (2h) / (T \times C_d \times 20,428)$$

where

Ao = total surface area of dewatering holes, ft2;

As = surface area of the basin, ft2;

h = head of water above the hole, ft;

C_d = coefficient of contraction for an orifice, approximately 0.6; and

T = detention time or time needed to dewater the basin, hours.

In all cases, an appropriate professional should design such structures. The designer should consider local hydrologic, hydraulic, topographic, and sediment conditions.

Limitations

Do not use a sediment basin with an earthen embankment or a rock dam in an area of continuously running water (live streams). Do not use a sediment basin in an area where failure of the earthen or rock dam will result in loss of life or damage to homes or other buildings. Do not use sediment basins in areas where failure will prevent the use of public roads or utilities.

Maintenance Considerations

Routine inspection and maintenance of sediment basins is essential to their continued effectiveness. Inspect basins after each storm event to ensure proper drainage from the collection pool and determine the need for structural repairs. Replace material eroded from earthen embankments or stones moved from rock dams immediately. Locate sediment basins in an area that is easily accessible to maintenance crews for removal of accumulated sediment. Remove sediment from the basin when the storage capacity has reached approximately 50 percent. Remove trash and debris from around dewatering devices promptly after rainfall events.

Effectiveness

The effectiveness of a sediment basin depends primarily on the sediment particle size and the ratio of basin surface area to inflow rate (Smolen et al., 1988). Basins with a large surface area-to-volume ratio are the most effective. Studies have shown that the following equation relating surface area and peak inflow rate gives a trapping efficiency greater than 75 percent for most sediment in the Coastal Plain and Piedmont regions of the southeastern United States (Barfield and Clar, in Smolen et al., 1988):

$$A = 0.01q$$

where A is the basin surface area in acres and q is the peak inflow rate in cubic feet per second.

USEPA (1993) estimates an average total suspended solids removal rate for all sediment basins of 55 percent to 100 percent. The average effectiveness is 70 percent.

Cost Considerations

For a sediment basin with less than 50,000 ft3 of storage space, the cost of installing the basin ranges from \$0.20 to \$1.30 per cubic foot of storage (about \$1,100 per acre of drainage). The average cost for basins with less than 50,000 ft³ of storage is approximately \$0.60 per cubic foot of storage (USEPA, 1993). If constructing a sediment basin with more than 50,000 ft³ of storage space, the cost of installing the basin ranges from \$0.10 to \$0.40 per cubic foot of storage (about \$550 per acre of drainage). The average cost for basins with greater than 50,000 ft3 of storage is approximately \$0.30 per cubic foot of storage (USEPA, 1993).

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Sediment Traps

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Minimum Measure: Construction Site Stormwater Runoff Control

Subcategory: Sediment Control

Description

Sediment traps are small impoundments that allow sediment to settle out of construction runoff. They are usually installed in a drainageway or other point of discharge from a disturbed area. Temporary diversions can be used to direct runoff to the sediment trap (USEPA, 1993). Sediment traps detain sediments in stormwater runoff to protect receiving streams, lakes, drainage systems, and the surrounding area. The traps are formed by excavating an area or by placing an earthen embankment across a low area or drainage swale. An



Sediment traps are used to collect sedimentladen runoff from disturbed areas on construction sites

outlet or spillway is often constructed using large stones or aggregate to slow the release of runoff (USEPA, 1992).

Applicability

Sediment traps are commonly used at the outlets of stormwater diversion structures, channels, slope drains, construction site entrance wash racks, or any other runoff conveyance that discharges waters containing sediment and debris.

Siting and Design Considerations

Sediment traps can simplify stormwater management on a construction site by trapping small amounts of sediment at multiple spots (USEPA, 1992). Note the natural drainage patterns, and place the traps in areas with the highest erosion potential. Design alternative diversion pathways to accommodate potential overflows.

Design a sediment trap to maximize the surface area for infiltration and sediment settling. This increases the effectiveness of the trap and decreases the likelihood of backup during and after periods of high runoff intensity. Site conditions dictate specific design criteria, but the minimum storage capacity should be 1,800 ft3 per acre of total

drainage area (Smolen et al., 1988). The volume of a natural sediment trap can be approximated using the following equation (Smolen et al., 1988):

Volume (ft3) = 0.4 x surface area (ft2) x maximum pool depth (ft)

In the siting and design phase, take care to situate sediment traps for easy access by maintenance crews. This allows for periodic inspection and maintenance. When excavating an area for a sediment trap, make sure the side slopes are no steeper than 2:1 and the embankment height no more than 5 feet from the original ground surface. Machine-compact all embankments to ensure stability. To reduce flow rate from the trap, line the outlet with well-graded stone.

The spillway weir for each temporary sediment trap should be at least 4 feet long for a 1 -acre drainage area and increase by 2 feet for each additional drainage acre added, up to a maximum drainage area of 5 acres.

Limitations

Do not use sediment traps for drainage areas greater than 5 acres (USEPA, 1993). The effective life span of these structures is usually limited to 24 months (Smolen et al., 1988). Although sediment traps allow eroded soils to settle, their detention periods are too short for removing fine particles like silts and clays.

Maintenance Considerations

The primary maintenance consideration for temporary sediment traps is removing accumulated sediment. Do this periodically to ensure that the trap continues to operate effectively. Remove sediments when the basin reaches about 50 percent sediment capacity. Inspect the sediment trap after each rainfall event to ensure that the trap is draining properly. Also check the structure for damage from erosion. Check the depth of the spillway and maintain it at a minimum of 1.5 feet below the low point of the trap embankment.

Effectiveness

Sediment trapping efficiency is a function of surface area and peak inflow rate (Smolen et al., 1988). Traps that provide pools with large length-to-width ratios have a greater chance of success. Sediment traps have a useful life of about 18 to 24 months (USEPA, 1993), but their effectiveness depends on the amount and intensity of rainfall and erosion, and proper maintenance. USEPA (1993) estimates an average total suspended solids removal rate of 60 percent. An efficiency rate of 75 percent can be obtained for most Coastal Plain and Piedmont soils by using the following equation (Barfield and Clar, in Smolen et al., 1988):

Surface area at design flow (acres) = (0.01) peak inflow rate (cfs)

Cost Considerations

The cost of installing temporary sediment traps ranges from \$0.20 to \$2.00 per cubic foot of storage (about \$1,100 per acre of drainage). The average cost is sbout \$0.60 per cubic foot of storage (USEPA, 1993).

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Spill Prevention and Control Plan

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Minimum Measure: Construction Site Stormwater Runoff Control

Subcategory: Good Houskeeping/Materials Management

Description

Spill Prevention and Control Plans (SPCP) should clearly state measures to stop the source of a spill, contain the spill, clean up the spill, dispose of contaminated materials, and train personnel to prevent and control future spills.

Applicability

SPCPs are applicable to construction sites where hazardous wastes are stored or used. Hazardous wastes include pesticides, paints, cleaners, petroleum products, fertilizers, and solvents.



Absorbent snakes can be used to protect storm drains from spills (Spill911, no date)

Siting and Design Considerations

When developing an SPCP, a construction site operator should identify potential spill or source areas, such as loading and unloading, storage, and processing areas; places where dust or particulate matter is generated; and areas designated for waste disposal. Also, evaluate spill potential for stationary facilities, including manufacturing areas, warehouses, service stations, parking lots, and access roads. Conduct this evaluation during the project planning phase, and reevaluate it during each phase of construction.

The SPCP should define material handling procedures and storage requirements and . outline actions necessary to reduce spill potential and impacts on stormwater quality. This can be achieved by:

- · Recycling, reclaiming, or reusing process materials, thereby reducing the amount of process materials that are brought into the facility
- Installing leak detection devices, overflow controls, and diversion berms
- · Disconnecting any drains from processing areas that lead to the storm sewer
- Performing preventative maintenance on storm tanks, valves, pumps, pipes, and other equipment

- Using material transfer procedures or filling procedures for tanks and other equipment that minimize spills
- Substituting less or non-toxic materials for toxic materials

The SPCP should document the locations of spill response equipment and procedures to be used and ensure that procedures are clear and concise. The plan should include step-by-step instructions for the response to spills at a facility. In addition, the spill response plan should:

- · Identify individuals responsible for implementing the plan
- · Define safety measures to be taken with each kind of waste
- Specify how to notify appropriate authorities, such as police and fire departments, hospitals, or municipal sewage treatment facilities for assistance
- State procedures for containing, diverting, isolating, and cleaning up the spill
- Describe spill response equipment to be used, including safety and cleanup equipment

The plan can be a procedural handbook or a poster to be placed in several locations at the site.

Limitations

Training is necessary to ensure that all workers are knowledgeable enough to follow procedures outlined in the SPCP. Make equipment and materials for cleanup readily accessible, and mark them clearly so workers can follow procedures quickly and effectively.

Maintenance Considerations

Update the SPCP regularly to accommodate any changes in the site, procedures, or responsible staff. Conduct regular inspections in areas where spills might occur to ensure that procedures are posted and cleanup equipment is readily available.

Effectiveness

An SPCP can be highly effective at reducing the risk of surface and ground water contamination; however, to ensure that procedures are followed, a construction site operator should provide worker training, appropriate materials and equipment for cleanup, and adequate staff time.

Cost Considerations

Spill prevention and control plans can be inexpensive to implement; however, adequate time and resources are needed to properly handle and dispose of spills.

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Storm Drain Inlet Protection

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Minimum Measure: Construction Site Stormwater Runoff Control

Subcategory: Sediment Control

Description

Storm drain inlet protection measures prevent soil and debris from entering storm drain drop inlets. These measures are usually temporary and are implemented before a site is disturbed.

There are several types of inlet protection:

Excavation around the perimeter of the drop inlet: Excavating a small area around an inlet creates a settling pool that removes sediments as water is released slowly into the inlet through small holes protected by gravel and filter fabric.

Fabric barriers around inlet entrances: Erecting a barrier made of porous fabric around an inlet creates a shield against sediment while allowing

There are many different ways to prevent sediment from entering storm drains.

water to flow into the drain. This barrier slows runoff while catching soil and other debris at the drain inlet.

Block and gravel protection: Standard concrete blocks and gravel can be used to form a barrier to sediments that permits water runoff to flow through select blocks laid

Sandbags can also be used to create temporary sediment barriers at inlets. For permanent inlet protection after the surrounding area has been stabilized, sod can be installed. This permanent measure is an aesthetically pleasing way to slow stormwater near drop inlet entrances and to remove sediments and other pollutants from runoff.

Applicability

All temporary inlet protection should have a drainage area no greater than 1 acre per inlet. Temporary controls should be constructed before the surrounding landscape is disturbed. Excavated drop inlet protection and block and gravel inlet protection are applicable to areas of high flow, where drain overflow is expected. Fabric barriers are recommended for smaller, flatter drainage areas (slopes less than 5 percent leading to the drain). Temporary drop inlet control measures are often used in sequence or with other erosion control techniques.



Siting and Design Considerations

With the exception of sod drop inlet protection, install these controls before any soil disturbance in the drainage area. Excavate around drop inlets at least 1 foot deep (2) feet maximum), excavating a volume of at least 35 yd3 per acre disturbed. Side slopes leading to the inlet should be no steeper than 2:1. Design the shape of the excavated area such that the dimensions fit the area from which stormwater is expected to drain. For example, the longest side of an excavated area should be along the side of the inlet expected to drain the largest area.

Stake fabric inlet protection close to the inlet to prevent overflow onto unprotected soils. Stakes should be at least 3 feet long and spaced no more than 3 feet apart. Construct a frame for fabric support during overflow periods, and bury it at least 1 foot below the soil surface. It should rise to a height no greater than 1.5 feet above the ground. The top of the frame and fabric should be below the downslope ground elevation to keep runoff from bypassing the inlet.

Block and gravel inlet barriers should be at least 1 foot high (2 feet maximum). Do not use mortar. Lay the bottom row of blocks at least 2 inches below the soil surface, flush against the drain for stability. Place one block in the bottom row on each side of the inlet on its side to allow drainage. Place 1/2-inch wire mesh over all block openings to prevent gravel from entering the inlet. Place gravel (3/4 to 1/2 inch in diameter) outside the block structure at a slope no greater than 2:1.

Do not consider sod inlet protection until the entire surrounding drainage area is stabilized. Lay the sod so that it extends at least 4 feet from the inlet in each direction to form a continuous mat around the inlet. Lay the sod strips perpendicular to the direction of flows. Stagger them so that the strip ends are not aligned. The slope of the sodded area should not be steeper than 4:1 approaching the drop inlet.

Limitations

To increase the effectiveness of these practices, use them with other measures, such as small impoundments or sediment traps (USEPA, 1992). In general, stormwater inlet protection measures are practical for areas receiving relatively clean runoff that is not heavily laden with sediment. They are designed to handle drainage from areas less than 1 acre (CASQA, 2003). To prevent clogging, storm drain control structures must be maintained frequently. If sediment and other debris clog the water intake, drop inlet control measures can actually cause erosion in unprotected areas.

Maintenance Considerations

Check all temporary control measures after each storm event. To maintain the capacity of the settling pools, remove accumulated sediment from the area around the drop inlet (excavated area, area around fabric barrier or block structure) when the capacity is reduced by half. Remove additional debris from the shallow pools periodically. The weep holes in excavated areas around inlets can become clogged, preventing water from draining out of the pools. If that happens, it might be difficult and costly to unclog the intake.

Effectiveness

Excavated drop inlet protection can be used to improve the effectiveness and reliability of other sediment traps and barriers, such as fabric or block and gravel inlet protection. The effectiveness of inlet protection alone is low for erosion and sediment control, longterm pollutant removal, and habitat and stream protection.

Cost Considerations

The cost of implementing storm drain inlet protection measures varies depending on the control measure used. Initial installation costs range from \$50 to \$150 per inlet

depending on the materials used, with an average cost of \$100 (USEPA, 1993). Maintenance costs can be high (up to 100 percent of the initial construction cost annually) because of the frequent inspection and repair needs. The Southeastern Wisconsin Regional Planning Commission has estimated the cost of installing inlet protection devices at \$106 to \$154 per inlet (SEWRPC, 1991).

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Straw or Hay Bales

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Minimum Measure: Construction Site Stormwater Runoff Control

Subcategory: Sediment Control

Description

Straw or hay bales have historically been used on construction sites for erosion and sediment control as check dams, inlet protection, outlet protection, and perimeter control. Many applications of straw bales for erosion and sediment control are proving ineffective due to the nature of straw bales, inappropriate placement, inadequate installation, or a combination of all three factors (Fifeld, 1999). In addition, straw bales are maintenance-intensive and can be expensive to purchase. Because many applications of straw and hay bales have been ineffective, EPA recommends that other BMP options are carefully considered. This fact sheet provides more information and options for alternatives to straw and hay bales.



bales should be used wherever possible

Limitations

Straw bales cannot be used to reduce erosion in a drainage channel because if a straw bale structure is installed across the channel, the cross-sectional area is reduced, resulting in increased velocity of stormwater flow (IECA, 2005). This would lead to increased erosion around the bales, widening the channel's cross-section.

Straw bales do not work well in areas with heavy rain or on sites with large drainage areas or steep slopes. Straw bales should never be used on streets or sidewalks as they cannot be properly staked into concrete or asphalt and will float away.

Straw bales are very impermeable and are not able to withstand high flows, and care must be taken during placement and installation to avoid failure from undercutting, overtopping, and end-running. USDA NRCS (no date) states that water depth should never exceed 1 foot at any one time and straw bale structures should never be installed across streams, ditches, or where flow is concentrated because they can exacerbate erosion and flooding.

Straw bale installations have a high failure rate. According to some erosion control experts, straw bale installations are seldom designed, installed, and maintained properly (Fifeld, 1999). In addition, straw bales are difficult to transport and to carry around on-site, especially when attempting to dispose of them when they are waterlogged. Oftentimes, the bindings break and the straw can wash into storm drains, causing clogging.

Straw bales will rot and fall apart over time, especially in areas of high rainfall, and therefore require intensive maintenance; they only last for approximately three months. Straw bales will float and therefore must be properly staked even in low flow conditions. As previously stated, in high flow conditions, the water will flow around a straw bale barrier or undercut spaces between the bales.

Another factor to consider is that straw bales may introduce undesirable non-native plants to the area if there are seeds in the bales.

Alternatives

The following is a list of typical applications for straw and hay bales and some alternative practices that have proven to be more effective.

Common uses of straw or hay bales	Alternative to straw or hay bales
Perimeter controls	Silt fence
Check dams	Rock check dams Fiber Rolls
Slope protection	Geotextiles Compost blankets
Storm drain inlet protection	Filter fabric, gravel bags, and other designs
Concrete washout structures	Prefabricated concrete washout containers

Considerations

If straw bales are used (only in limited circumstances), each bale should be a minimum of 14 inches wide, 18 inches high, 36 inches long and should have a minimum mass of 50 pounds. The straw bale should be composed entirely of vegetative matter except for the binding material. Bales should be bound by steel wire or nylon or polypropylene string. Jute and cotton binding should not be used. Baling wire should be a minimum 14 -gauge diameter. Nylon or polypropylene string should be approximately 12-gauge in diameter with a breaking strength of 80 pounds of force. Wood stakes should be commercial quality lumber that is free from decay, splits, or cracks longer than the thickness of the stake, or other defects that would weaken the stakes and cause them to be structurally unsuitable. Steel bar reinforcement should be equal to a #4 designation or greater. End protection should be provided for any exposed bar reinforcement.

Maintenance Considerations

Straw bales degrade, and rotting bales will need to be replaced on a regular basis (as often as every 3 months depending on local conditions). Erosion from washouts around the bales will need to be repaired. Sediment that settles in ponded areas around correctly installed bales will need to be cleaned out when the sediment accumulation

reaches one-third of the bale height. Straw bales will also have to be removed when they burst open or are no longer needed.

Effectiveness

Straw bale barriers have not been as effective as expected due to improper use, such as if they are placed incorrectly in drainageways where runoff volumes and velocities have caused the barriers to wash out. In addition, failure to stake and entrench the straw bale has allowed undercutting and end flow.

Often straw bale barriers will fill to capacity after small storms and can be washed away if not staked correctly. Straw bale structures cannot be designed for large storms and tend to fail during large runoff events.

Cost Considerations

Straw bales cost \$5 to \$7 each, or \$9 to \$15 per bale installed (\$3 - \$5 per linear foot). This does not include labor or material costs associated with maintenance.

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Temporary Diversion Dikes

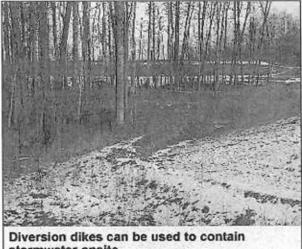
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Minimum Measure: Construction Site Stormwater Runoff Control

Subcategory: Runoff Control

Description

An earthen perimeter control usually consists of a dike or a combination dike and channel constructed along the perimeter of and within the disturbed part of a site. An earthen perimeter control is a ridge of compacted soil, often accompanied by a ditch or swale with a vegetated lining, at the top or base of a sloping disturbed area. Depending on its location and the topography of the landscape, an earthen perimeter control can achieve one of two goals.



stormwater onsite

When on the upslope side of a

site, earthen perimeter controls help to prevent surface runoff from entering a disturbed construction site. An earthen structure located upslope can improve working conditions on a construction site. It can prevent an increase in the total amount of sheet flow runoff traveling across the disturbed area and thereby lessen erosion on the site.

Earthen perimeter control structures also can be located on the downslope side of a site. They divert sediment-laden runoff created onsite to onsite sediment-trapping devices, preventing soil loss from the disturbed area.

These control practices are called temporary diversion dikes, earth dikes, and interceptor dikes. No matter what they are called,, all earthen perimeter controls are constructed in a similar way with a similar objective -- to control the velocity or route (or both) of sediment-laden stormwater runoff.

Applicability

Temporary diversion dikes apply where it is desirable to divert flows away from disturbed areas such as cut or fill slopes and to divert runoff to a stabilized outlet (USEPA, 1992). The dikes can be erected at the top of a sloping area or in the middle of a slope to divert stormwater runoff around a disturbed construction site. In this way, earth dikes can be used to reduce the length of the slope across which runoff travels,

reducing the erosion potential of the flow. If diversion dikes are placed at the bottom of a sloping disturbed area, they can divert flow to a sediment-trapping device. Temporary diversion dikes are usually appropriate for drainage basins smaller than 5 acres. With modifications they can service areas as large as 10 acres. With regular maintenance, earthen diversion dikes have a useful life span of about 18 months.

To prevent stormwater runoff from entering a site, earthen perimeter controls can be used to divert runoff from areas upslope around the disturbed construction site. A continuous, compacted earthen mound is constructed along the upslope perimeter of the site. As an additional control measure, a shallow ditch can accompany the earthen

Siting and Design Considerations

The siting of earthen perimeter controls depends on the topography of the area surrounding the construction site. Another factor is whether the goal is to prevent sediment-laden runoff from entering the site or to keep stormwater runoff from leaving the site. When determining the appropriate size and design of earthen perimeter controls, consider the shape and drainage patterns of the surrounding landscape. Also consider the amount of runoff to be diverted, the velocity of runoff in the diversion, and the erodibility of soils on the slope and in the diversion channel or swales (WA State Dept. of Ecology, 2005).

Construct diversion dikes and fully stabilize them before any major land disturbance begins. This approach makes the diversion measure effective as an erosion and sediment control device.

The top of earthen perimeter controls designed as temporary flow diversion measures should be at least 2 feet wide. The bottom width at ground level is typically 6 feet. The minimum height for earth dikes should be 18 inches, with side slopes no steeper than 2:1. At points where vehicles will cross the dike, make sure the slope is no steeper than 3:1 and make the mound gravel rather than soil. This design makes the dike last longer and strengthens the point of vehicle crossing.

If a channel is excavated along the dike, its shape can be parabolic, trapezoidal, or Vshaped. Before any excavating or mound-building, remove all trees, brush, stumps, and other objects in the path of the diversion structure. Till the base of the dike before laying the fill. The maximum design flow velocity should range from 1.5 to 5.0 feet per second, depending on the vegetative cover and soil texture.

Most earthen perimeter structures are designed for short-term, temporary use. If the expected life span of the structure is more than 15 days, seed the earthen dike and the accompanying ditchwith vegetation immediately after construction. This increases the stability of the perimeter control and can decrease the need for frequent repairs and maintenance.

Limitations

Earth dikes are an effective means of diverting sediment-laden stormwater runoff around a disturbed area. But the concentrated runoff in the channel or ditch has increased erosion potential. Direct diversion dikes to sediment-trapping devices, where sediment can settle out of the runoff before it is discharged to surface waters. Sediment -trapping devices that work with temporary diversion structures include sediment basins, sediment chambers/filters, and any other structures designed to allow sediment to be collected for proper disposal.

If a diversion dike crosses a vehicle roadway or entrance, its effectiveness can be reduced. When possible, design diversion dikes to avoid crossing vehicle pathways.

Maintenance Considerations

Inspect earthen diversion dikes after each rainfall to ensure continued effectiveness. Maintain dikes at their original height. Repair any decrease in height due to settling or erosion immediately. To remain effective, earth dikes must be compacted at all times. Regardless of rainfall frequency, inspect dikes at least once every 2 weeks for evidence of erosion or deterioration.

Effectiveness

When properly placed and maintained, earth dikes used as temporary diversions can control the velocity and direction of stormwater runoff. Used by themselves, they do not have any pollutant removal capability. They must be used with an appropriate sediment -trapping device at the outfall of the diversion channel.

Cost Considerations

The cost of constructing an earth dike can be broken down into two components: (1) site preparation (including excavation, placement, and compacting of fill) and grading, and (2) site development, including topsoiling and seeding for vegetative cover. The Southeastern Wisconsin Regional Planning Commission (1991) estimated the total cost of site preparation to be \$46.33 to \$124.81 for a 100-foot dike with 1.5-foot-deep, 3:1 side slopes. The cost of site development was estimated at \$115.52 to \$375.44. The total cost was between \$162 and \$500. The cost for constructinig diversion berms range from \$15 to \$55 per ft for both earthwork and stabilization and depends on the availability of suitable material, site location, and access. Small dikes range from \$2.50 to \$6.50 per linear ft and large dikes cost about \$2.50 per cubic yard of earth (CASQA, 2003).

References

CASQA, 2003. California Constrcution BMP HandbookSection 3; EC-9 Earth Dikes and Drainage Swales Fact Sheet. http://www.cabmphandbooks.org/Construction.asp

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